A Study of the Effects of Competition in the Tax-exempt Bond Market

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This is a study of the effects of competition upon underwriting costs, reoffering yields, and the financing costs to issuers of tax-exempt bonds. It provides estimates of the marginal effects of changes in the degree of competition, as measured by independent bids submitted by underwriters syndicates, upon the terms of newly issued tax-exempt bonds holding constant default risk, issue size, level of interest rates, etc. The paper is of theoretical interest because it applies Stigler's theory of information to the explanation of phenomena—in particular, the behavior of reoffering yields—that cannot be explained with the neoclassical model of competition which implicitly postulates that information is a free good.

This paper reports the results of a study of two aspects of the tax-exempt bond market. These are (1) the exclusion of commercial banks from underwriting an important class of tax-exempts, revenue bonds;[1] and (2) the effect of variations in the degree of competition in underwriting, as measured by the number of bids submitted for new issues, upon (*a*) the difference between the buying and selling prices of underwriters, (*b*) the selling prices or reoffering yields of underwriters to the investing public,

I am indebted to (1) Potluri M. Rao, graduate student in the Department of Economics at the University of Chicago for running the regressions used in this study; (2) Paul Tracy of the First National City Bank of New York and Herman Charbonneau of the Chemical Bank–New York Trust Company for supervising the assembly of the data used and for many helpful discussions dealing with the practical aspects of the municipal bond business; and (3) Armen A. Alchian of UCLA, and Merton Miller and George Stigler of the University of Chicago for help with the analysis. The views expressed are not necessarily the views of those named.

[1] See Investment Bankers Association (1968, p. 24). Both general obligation and revenue bonds are obligations of nonfederal governmental units such as states, municipalities, school districts, authorities, etc. The chief difference between these two classes of bonds is the source of the funds to be used to meet payments of interest and principal. Revenue bonds are secured by the income derived from specific taxes or user charges. By contrast, general obligations are secured by the general taxing power of the issuer.

and (*c*) the costs of borrowing for the issuers of tax-exempts. More specifically, this study attempts to answer the following questions: Is the prohibition of bank underwriting of revenue bonds of any economic significance? And, how sensitive are the costs of underwriters' services for issuers to the intensity of competition among underwriters?

The intensity of competition in underwriting new issues of tax-exempts has the expected effect on underwriters' spreads, that is, the difference between buying and selling prices; spreads decrease as the degree of competition increases. Of far greater interest and importance, both theoretically and empirically, is the somewhat unexpected discovery that a relationship exists between the reoffering prices of bonds to the investing public by underwriters and the intensity of competition in underwriting. More specifically, reoffering yields decline, or prices rise, as the degree of competition increases. This finding is inconsistent with the usual assumption of complete knowledge associated with perfect competition; in a world in which information is free, reoffering yields ought to be independent of the degree of competition. By contrast, in a world in which information is a scarce resource, a postulate of Stigler's economics-of-information theory which is employed to explain the behavior of reoffering yields, bids for a new issue by underwriters can be usefully interpreted as a means of scanning the population of would-be buyers of tax-exempts for that subset for whom a forthcoming issue is most valuable.[2] A bid submitted by an underwriter incorporates his knowledge of what his customers are willing to pay for a prospective issue. Hence, bids reveal the underwriters whose customers will pay the most for a forthcoming issue. Competitive bidding is a way of utilizing "knowledge which is not given to anyone in its totality."[3]

In fact, the variation of reoffering yields with the intensity of competition is substantially greater, as measured in dollars and cents, than the variation of spreads with the degree of competition. Consequently, for the issuers of tax-exempts, the important gains from competition stem from the impact of competition upon the prices at which bonds are sold and, by implication, the prices paid by underwriters to issuers.

In order to answer the questions that have been raised and to show how the conclusions presented were obtained, this paper is divided into three major sections. These deal with (1) the effects of entry restrictions on the number of bids submitted for a tax-exempt bond issue, (2) the effects of variations in the number of bids submitted upon underwriters' spreads, and (3) the effects of variations in bids submitted upon reoffering yields. In this introductory section, the data used in this investigation are described, some summary statistics and the results of previous

[2] Stigler (1961, p. 213).

[3] Hayek (1945, p. 519).

studies are presented, and the nature of the statistical problems encountered is outlined.

The banking legislation of the early 1930s prohibited the underwriting by commercial banks of revenue bonds, that is, tax-exempts secured by specific taxes or user charges.[4] By contrast, general obligation (G.O.) bonds, the other major class, are secured by the general taxing power of the issuer.[5] Studies of the economic effects of the prohibition of bank underwriting of revenues have appeared in hearings of congressional subcommittees and the *Federal Reserve Bulletin*.[6] Articles dealing with issues relevant for resolving this question have appeared in various economic journals.[7]

Two bodies of data are utilized to extract the evidence to be presented. One consists of observations on all new issues, 9,420 in number, reported by the *Bond Buyer* as submitted for competitive bids between spring of 1959 and spring of 1967. This is probably the most extensive body of data on tax-exempt bonds ever assembled. The aggregate value of these issues was roughly 48 billion dollars, with about one-fourth, or 12 billion dollars, accounted for by revenue bonds.[8] For each issue, to the extent that the *Bond Buyer* reports were complete, data were collected that described the economic characteristics of new issues. The variables observed were (1) quality rating, both Standard and Poor's and Moody's; (2) size of issue; (3) average life of issue; (4) amount of prior outstanding tax-exempt bonds of the issuer; (5) absence or presence of call provisions and, if the bonds were callable, the first call date; (6) date of issue; (7) number of bids submitted; (8) G.O. or revenue; (9) dollar cost of issue to underwriters; (10) dollar receipts of underwriters derived from reoffering prices; (11) twenty-year reoffering yield, that is, the yield-to-maturity of the twenty-year bond in an issue, (12) the so-called net interest cost; and (13) whether the manager of the winning syndicate is a commercial bank or an investment banker.[9]

The other body of data constitutes—in effect, if not by design—a test

[4] Commercial banks can neither underwrite new revenue issues nor make a market, that is, operate as dealers, in the secondary market for revenue bonds. However, banks can, and do, buy revenue bonds for their own account or portfolio, either as participants in underwriting syndicates that buy tax-exempts from original issuers, or as customers of underwriting syndicates, or from dealers in the secondary market.

[5] The aggregate value of outstanding tax-exempt bonds is well in excess of 100 million (see Investment Bankers Association 1968, p. 32).

[6] See U.S. Congress (1967), *Federal Reserve Bulletin* (1967), and Smith (1967).

[7] West (1965*b;* 1967, p. 241).

[8] Revenues constitute about one-third of all new tax-exempts issued but only one-fourth of all tax-exempts submitted for competitive bids.

[9] The data were taken from the so-called sheet summaries to the *Bond Buyer* which are not an integral part of that publication. If the data were incomplete, as they were relatively infrequently, they were, nevertheless, included in the sample and used whenever the missing data were not relevant.

of what would happen if banks were to be permitted to underwrite revenues. These data were a consequence of rulings by a former comptroller of the currency, James J. Saxon. While he held that office, Saxon ruled that a number of issues of tax-exempt bonds, previous issues of which had been regarded as revenue bonds, were, in fact, general obligations. These tax-exempt bonds whose status changed from revenues to G.O.'s were named Saxon G.O.'s by professionals in the bond business.[10] These data enable an investigator to hold the issuer constant and examine what happens to the number of bids submitted before and after its obligations became eligible for bank bidding. Saxon G.O.'s, therefore, represent a test case of what would happen if banks were permitted to underwrite revenue issues. All of the issues Saxon's office redefined were utilized, subject to certain constraints to be described later. The pertinent data on bids, date of issue, etc., for these issues were obtained from published sources.

In general, there appears to be agreement that (1) G.O. bonds receive more bids than revenue bonds when both classes of bonds are submitted for competitive bids; (2) one-third of revenue bonds in contrast with about 6 percent of G.O. issues are negotiated, that is, are not submitted for competitive bids: and (3) G.O. bonds are of higher quality, shorter term-to-maturity, and, on average, issued in smaller amounts. These characteristics must be held constant in order to determine whether there is truly a difference in the number of bids submitted.

An important, if not the most important, study of this question was undertaken by the Federal Reserve Board. The study concluded:

> Since the number of bidders was an important determinant of the net interest cost, and is a topic central to the issue of whether the number of possible underwriters should be increased, the other factors affecting this variable are also relevant. As can be seen from the equations, one may confidently say that issues with higher ratings receive more bids than those with lower ratings, the longer the maturity, the fewer the number of bidders, that general obligations receive more bids than revenues—a full 1.5 on the average—and that the higher the level of interest rates (the "Bond Buyer Index"), the fewer the number of bidders.[11]

The Federal Reserve study suggests that the chief problems confronting investigators are (1) to isolate the effects of difference in average

[10] Since Saxon's departure from the office of comptroller of the currency, a number of these issues have reverted to their original revenue status.

[11] See *Federal Reserve Bulletin* (August 1967, appendix, p. 8). The text (see p. 1300) and the article are inconsistent on this point, since the text reports two more bids. Presumably, there is a typographical error in the text, since the bid regression equation has −1.539 as the coefficient for the general obligation–revenue dummy.

maturity, issue size, and rating upon the number of bids submitted for an issue; and (2) if a difference in the number of bids submitted remains after removing the effects of these variables, to determine the relationship, if any, of underwriting costs and the prices paid for bonds by underwriters to the number of bids.

I. Entry Restrictions and the Number of Bids Submitted for New Issues

Is there a difference in the number of bids submitted for G.O. and revenue issues after adjustment for other differences in the economic characteristics of these two classes of issues? The answer to this question, provided by both this and the Federal Reserve's study, is yes. Although somewhat different variables were used, the data were obtained from independent sources, and the fraction of the observed variance explained differed, answers to this question were the same.

As with the Federal Reserve study, a multiple regression model was employed in an attempt to explain the number of bids submitted for new issues. The variables in this analysis were: (1) type of issue (revenue or G.O.); (2) issue size; (3) prior issues outstanding; (4) rating; (5) call provisions; (6) level of interest rates; (7) rate of change of interest rates; (8) Blue List, that is, aggregated value of all tax-exempts listed for sale by dealers during week of issue; (9) number of G.O. issues that came to market, as measured by the number in the sample, during the week of issue; (10) number of revenue issues that came to market, as measured by the number in this sample, during the week of issue; (11) average maturity; and (12) trend.[12] (These variables are described more specifically in the footnote to table 1.)

Bringing variables other than the G.O.-revenue characteristic into analysis represents an attempt to hold differences constant between the two classes of bonds that are not attributable to entry constraints in underwriting. Issue size, time, level of interest rates, Blue List, rate of change of interest rates, and the flows to market of G.O. and revenue issues were entered into the regression equation linearly. Outstandings and average maturity were entered logarithmically, and two series of dummies were used, one for call provisions and the other for rating. Five dummies were entered for five call-date classes with the excluded set being noncallable bonds. Standard and Poor's ratings were preferred to Moody's because Standard and Poor's rates more bonds; hence, less data are lost.[13]

[12] The data for variables 9 and 10 have shortcomings. They do not include (1) negotiated issues, and (2) small issues under 1 million, because they are usually not reported by the *Bond Buyer*.

[13] For some of the regressions to be presented, Moody's was used as an alternative to Standard and Poor's with little or no perceptible difference in results.

One dummy was used for each of the three rating classes, AAA, AA, and A; the excluded set was BBB. Less than 1 percent of tax-exempts in this body of data carry a rating below BBB.[14] Consequently, little was lost by ignoring ratings below BBB.

The resulting regression equation explained about one-third of the observed variance (see table 1). The G.O.-revenue distinction proved significant as it did for the analysis published by the Federal Reserve Board. General obligations received 0.81 more bids than revenues when one abstracts from the other variables in the regression. The regression coefficients, t-values, and partial correlation coefficients are in table 1.

The Federal Reserve study explained 28 percent of the variance in bids. In that study: (1) when continuous functions were used, all were linear; (2) geographical region in which issuer is located was an indepen-

TABLE 1

BID REGRESSION:* COMBINED SAMPLE OF GENERAL OBLIGATIONS AND REVENUES

Variable	Regression Coefficient	t-Value	Partial Correlation
1. Issue size	-0.11×10^{-3}	−33.0	−.34
2. Outstandings, in logs	0.80×10^{-1}	6.0	$.65\times10^{-1}$
3. Level of White's	−3.5	−17.0	−.18
4. Rate of change of White's	−1.4	− 6.3	$-.68\times10^{-1}$
5. Time, in weeks	0.45×10^{-2}	9.1	$.98\times10^{-1}$
6. Flow of G.O. issues	-0.15×10^{-1}	− 2.9	$-.31\times10^{-1}$
7. Flow of revenue issues	-0.53×10^{-1}	− 5.2	$-.56\times10^{-1}$
8. Blue List	-0.10×10^{-5}	− 2.5	$-.27\times10^{-1}$
9. Maturity, in logs	-0.63×10^{-1}	− 0.66	$-.71\times10^{-2}$
10. Call provisions:			
a) Less than 5 years	−1.7	−10.0	−.11
b) 6–9 years	−1.0	− 7.6	$-.82\times10^{-1}$
c) 10–14 years	−0.33	− 9.1	$-.98\times10^{-1}$
d) 15–19 years	−0.44	− 3.5	$-.38\times10^{-1}$
e) 20 or more	−0.10	− 0.49	$-.52\times10^{-2}$
11. Rating, Standard and Poor's:			
a) AAA	4.5	29.0	.30
b) AA	3.8	39.0	.39
c) A	1.7	20.0	.21
12. G.O.-revenue dummy	−0.81	− 7.6	$-.82\times10^{-1}$

NOTE.—1, in thousands; 2, in thousands; 3, the level of interest rates is measured by the yield, published weekly, of the highest quality twenty-year bond of current coupon available in the market; this series is known as White's index of 100 and is published by Standard Statistics which is part of Standard and Poor's; 4, this week's minus last week's rate; 5, in weeks; 6, number of new G.O. issues coming to market during week in which issue observed receives bids; 7, number of new revenue issues coming to market during week in which issue observed receives bids; 8, in millions; 9, in years and fractions thereof.

* R^2 = .332; constant, 16.3; t-value, 21.4; 8,614 observations; residual variance 8.7; standard error of estimate, 2.9.

[14] The foregoing represents the product of some experimentation combined with intuition. The call provisions yield virtually the same results, if not better, if call-date classes are introduced in continuous form logarithmically, with noncallable bonds regarded as callable on the maturity date. Similarly, ratings yield virtually the same results if entered linearly. The value of all general obligation issues, revenue issues, and all issues coming to market during the week of issues were tried linearly with generally insignificant results.

dent variable; (3) outstandings, rate of change of interest rates, the Blue List, the flow variables, and time were not used; (4) the data were obtained by questionnaire for the years 1964, 1965, and 1966; (5) AAA bonds were excluded on the grounds that there were too few; (6) Moody's ratings were used; and (7) the presence or absence of call provisions was ignored. One difference in results is a negative coefficient for average maturity.

It is, at this point, more useful to consider the separate regressions for G.O.'s and revenues than to dwell on the differences between the results presented here and those of the Federal Reserve Board study. Aggregation of the two classes of bonds into one regression conceals significant differences (see table 2). In particular, the separate regressions reveal that there has been no trend in bids for revenues but a strongly positive trend for G.O.'s (row 5). Over the eight years observed, the number of bids submitted for G.O.'s increased by more than two. During the entire period, G.O. issues received on average 6.82 bids (SD, 3.7) against 4.81 (SD, 2.6) for revenues.[15] Therefore, the bid advantage of G.O.'s over revenues at the end of the period studied, given the G.O.-revenue dummy, is well in excess of two.

For G.O.'s, the trend in bids, that is, the relationship of bids to time, was positive for all rating categories. In addition, the higher the quality rating, the stronger the trend. For AAA's, the trend has been two and a half times; for AA's, twice; and A's, one and a half times the trend for BBB's. In contrast to G.O.'s, evidence of the existence of positive trends in bids for revenues is weak or nonexistent, with the exception of AA revenues (see table 3). Indeed, for BBB revenues, it is likely (t-value, -1.4) that it was negative.

Similarly, separate regressions reveal diversity in the relationship between average maturity and bids. Evidently, investment bankers, probably because of customer preferences, prefer to bid for long relative to short maturities. Converse preferences hold for commercial bankers. Clearly, the longer term-to-maturity of revenues is not an explanation of the observed difference in bids between G.O.'s and revenues. If revenues were of shorter term, the difference in bids observed would be even larger. Average maturity is not significant for the pooled data because the negative relationship of maturity to bids for G.O.'s is offset by a positive relationship for revenues.

[15] These are means determined by assuming every issue is just as important as every other issue. When means are weighted by issue size, the average number of bids submitted is smaller and the average maturity greater. (The average life of revenue issues is seventeen years against twelve for general obligations, and the average issue size of revenues is 7 million against 5 million for general obligations.) Whether means are weighted by issue size, general obligation bonds received more bids than revenues and were of shorter average life. Moreover, weighting by size left unchanged the difference between general obligation and revenue means for both bids and average maturity.

TABLE 2

SEPARATE GENERAL OBLIGATION AND REVENUE REGRESSIONS:* BIDS DEPENDENT VARIABLE

VARIABLES	REGRESSION COEFFICIENT		*t*-VALUE		PARTIAL CORRELATION	
	G.O.	Revenue	G.O.	Revenue	G.O.	Revenue
1. Issue size	-0.12×10^{-3}	-0.81×10^{-4}	−31.0	−15.0	−.35	−.36
2. Outstandings, in logs	0.91×10^{-1}	0.58×10^{-1}	5.9	2.6	$.71\times10^{-1}$	$.65\times10^{-1}$
3. Level of White's	−3.6	−2.8	−16.0	− 7.9	−.19	−.19
4. Rate of change of White's	−2.3	+1.9	− 6.7	0.66	$-.80\times10^{-1}$	$+.17\times10^{-1}$
5. Time, in weeks	0.50×10^{-2}	-0.42×10^{-4}	8.8	0.05	.10	$-.12\times10^{-2}$
6. Flow of G.O. issues	-0.22×10^{-1}	0.53×10^{-2}	− 3.7	0.58	$-.44\times10^{-1}$	$.15\times10^{-1}$
7. Flow of revenue issues	-0.10×10^{-1}	−0.12	− 0.82	− 8.1	$-.98\times10^{-2}$	−.20
8. Blue List	-0.85×10^{-6}	-0.90×10^{-6}	− 1.9	− 1.3	$-.22\times10^{-1}$	$-.33\times10^{-1}$
9. Maturity, in logs	−0.39	0.55	− 3.6	3.2	$-.43\times10^{-1}$	$.80\times10^{-1}$
10. Call provisions:						
a) Less than 5 years	−2.0	−0.84	− 8.5	− 2.8	−.10	$-.71\times10^{-1}$
b) 6–9 years	−0.86	−0.50	− 4.2	− 1.8	$-.50\times10^{-1}$	$-.45\times10^{-1}$
c) 10–14 years	−0.82	−0.16	− 7.4	− 0.57	$-.89\times10^{-1}$	$-.14\times10^{-1}$
d) 15–19 years	−0.36	0.30	− 2.5	0.89	$-.30\times10^{-1}$	$+.22\times10^{-1}$
e) 20 or more	0.13	1.4	0.57	2.9	$+.69\times10^{-2}$	$+.73\times10^{-1}$
11. Rating, Standard and Poor's:						
a) AAA	4.9	1.9	30.0	4.5	.34	.11
b) AA	4.3	1.9	39.0	10.0	.42	.26
c) A	1.8	1.1	19.0	7.3	.22	.18

* 8,614 observations: 1,603 revenues, 7,011 G.O.'s. For G.O.'s: $R^2 = .33$; constant, 17.0; *t*-value, 19.6; residual variance, 9.2; standard error of estimate, 3.0. For revenues: $R^2 = .26$; constant, 13.0, *t*-value, 9.4; residual variance, 5.1; standard error of estimate, 2.3.

TABLE 3

TRENDS IN BIDS AS A FUNCTION OF RATING*

RATING	REGRESSION COEFFICIENT		t-VALUE	
	G.O.	Revenue	G.O.	Revenue
AAA.....	0.78×10^{-2}	0.15×10^{-2}	3.3	0.90
AA.....	0.62×10^{-2}	0.32×10^{-2}	3.0	3.5
A.....	0.46×10^{-2}	-0.11×10^{-2}	1.6	−0.55
BBB.....	0.31×10^{-2}	-0.19×10^{-2}	3.3	−1.4

* Measured in bids per week.

Disaggregation also reveals marked differences in the sensitivity of bids to rating; the number of bids submitted for G.O.'s is far more sensitive to rating than it is for revenues (table 2, row 11, *a*, *b*, *c*). For A-rated bonds, the most frequently observed rating, the bid advantage over BBB for general obligations is almost one bid greater than it is for revenues. For AA-rated bonds, the next most frequently observed rating, the general obligation bid advantage over BBB is in excess of two bids greater than the corresponding relationship for revenues.

The foregoing analysis suggests that, even in the absence of a systematic bid advantage for G.O.'s, the issuers of revenue bonds that fall into the first three rating classes would gain additional bids if banks could underwrite their bonds. These additional bids would stem from the apparent comparative advantage of commercial banks, which is implied by the bidding pattern for G.O.'s, in underwriting higher-quality tax-exempts. Conversely, if commercial banks were to drop any of their present business as a result of the removal of legal restraints, the business dropped would be the underwriting of low-quality G.O. issues. This analysis also implies that, to the extent that investment bankers underwrite G.O.'s, they are overrepresented in underwriting low-quality or relatively risky issues. Similar implications follow from the relationship of average maturity to bids for the two classes of underwriters.

The findings displayed in table 2 (rows 10, *a*–10, *e*) also indicate a difference between G.O.'s and revenues with respect to sensitivity to call provisions. Callable bonds typically receive fewer bids than noncallable bonds, and the influence of call provisions upon the number of bids submitted is inversely related to the time span to the first call date. The only exception appears to be the fifth call-date class, twenty years and over, for revenues.[16] This is generally consistent with the finding that bids decrease as quality decreases. High quality and noncallability have similar implications for investors; both reduce the variance in money flows. The

[16] About one-third of the general obligations in the sample were callable, whereas 93 percent of the revenues were callable. The behavior of the fifth call-date class is anomalous and generally inconsistent with the explanation presented above.

greater sensitivity of bids for G.O.'s to call provisions is not inconsistent with this explanation. The call provisions for G.O.'s are more stringent than they are for revenues: par calls for callable G.O.'s are frequent, whereas revenues are usually called at premiums.[17]

The inverse relationship shown by the bid regressions between bids and the level of interest rates revealed is consistent with the results obtained by the Federal Reserve.[18] Yields of tax-exempts, like obligations of the federal government, are procyclical; yields are high about cyclical peaks and low at troughs. Commercial banks buy for their own portfolios about 40 percent of the value of all new issues. The acquisition of tax-exempts by commercial banks, like their acquisition of federal obligations, has a contracyclical pattern. They are heavy buyers at cyclical troughs and light buyers—if not, on balance, sellers—at peaks.[19] To the extent that underwriters are specialized in serving commercial bank demands, their willingness to bid for new issues would also exhibit a contracyclical pattern, thereby producing the observed relationship. Moreover, bids for bonds that commercial banks are apt to buy, short maturities and high-quality issues, would decrease more than bids generally. This suggests that bids for G.O.'s ought to be more sensitive to the level of rates than bids for revenues.

The regression coefficients for the level of rates for G.O.'s, -3.6, and for revenues, -2.8, is a weighted average for all four rating classes and conceals important differences. Commercial banks prefer high-quality and short-maturity issues. Hence when commercial banks withdraw from the tax-exempt market about cyclical peaks, their agents in the acquisition of tax-exempts, the commercial bank underwriters, also withdraw from the submission of bids for the type of tax-exempts their customers prefer. This phenomenon is revealed when one observes the coefficients of White's (the yield of the highest-quality twenty-year tax-exempt) for high-quality tax-exempts; for AA-rated bonds, the coefficient for White's is -4.85 for G.O.'s in contrast with -1.64 for revenues.

[17] This suggests that pooling general obligations and revenues to estimate the bid advantage of general obligations will lead to too low an estimate. The stringent par calls for general obligations vis-à-vis revenues and the greater frequency of callable bonds among revenues will lead to too great an estimate of the effect of the callability of revenues upon bids.

[18] See *Federal Reserve Bulletin* (1967, appendix, p. 7). To obtain this interpretation, the variable X_{17}, which is identified as X_{15}, is assumed to be the Bond Buyer Index. The level of interest rates is measured throughout this study by the yield of the highest-quality tax-exempt of current coupon outstanding. In the municipal bond field, this weekly series is known as White's index of 100.

[19] Robinson (1960, p. 159) notes that commercial banks have been volatile investors. Phelps (1961, p. 289) shows that commercial banks acquired, on balance, tax-exempts equal to 81 percent of all tax-exempts issued in the second quarter of 1968. By contrast, commercial banks, on balance, sold tax-exempts equivalent to 25 percent of all tax-exempts issued in the second quarter of 1960.

There is some reason for believing that the payment for risk bearing, that is, yield differentials as a function of quality differences, is positively related to the level of rates. This implies that low-quality bonds are viewed as being comparatively more desirable when rates are low. Therefore, bids ought to be inversely related to interest rates, and this relationship should be stronger for G.O.'s than for revenues, because bids for G.O.'s are more sensitive to quality considerations. Unfortunately, this relationship is difficult to observe because of another force working in an opposite direction; this is the relationship of commercial bank acquisition of tax-exempts to the level of interest rates. For revenues alone, the evidence on this point is fragmentary but consistent with the hypothesis enunciated; the coefficient for AA revenues (-1.64) is the only one significantly different from the coefficient of BBB's (-3.08), and it is almost one-half of the absolute size of the latter. For G.O.'s, the only significant difference was also between AAs (-4.85), and BBBs (-2.99).[20]

There is a negative relationship between number of bids and the number of new issues. For the regression using all the data, the number of both revenue and G.O. issues coming to market during the week a particular issue comes to market affects the number of bids this issue receives. However, when separate regressions are run for revenues and G.O.'s, the number of bids submitted for G.O.'s is affected only by the flow of G.O.'s during the week of issue; the flow of revenues plays no role. This implies that the underwriters of G.O.'s are not interested in underwriting revenues; this is consistent with the view that investment bankers have abandoned the market for underwriting G.O.'s, and legal constraints preclude the bank underwriting of revenues. This interpretation is also consistent with the finding that bids submitted for revenues are affected by the number of revenue issues coming to market but not the number of G.O. issues. It suggests that the underwriters of revenues do not generally underwrite G.O.'s. In addition, it appears that the number of bids submitted for revenues is more sensitive to the flow of revenues than is true for G.O.'s. Hence, the supply of underwriting services for revenues is less elastic than it is for G.O.'s. These findings suggest that the legal restrictions on bank entry have economic effects; investment bankers can bring resources into the underwriting of G.O.'s, but the converse is not true.

The most interesting difference between the results presented here and those of the Federal Reserve study is the estimate of the G.O.-Revenue dummy, that is, the expected difference in the number of bids submitted abstracting from other differences between the two classes of bonds; 1.5

[20] The signs of the coefficients constitute additional evidence on this point. All three high-quality G.O. rating categories had coefficients that were larger, in absolute size, than the coefficient for BBB G.O.'s. By contrast, the coefficient for the three highest-rated revenue classes was smaller than the coefficient for BBBs, with the exception of AAAs.

in the Federal Reserve against 0.81 here, despite the exclusion of AAAs from the Federal Reserve investigation.[21] One reason why the Federal Reserve Board estimate of the bid difference is larger than the one presented here is that they did not abstract from trend. Their data are for the years 1964, 1965, and 1966. On the average for these three years, G.O.'s were receiving about one and a half more bids than in 1959, whereas, for revenues, there were fewer bids in these years than in 1959.

Questions can be raised about the confidence one ought to place upon these estimates of differences in the number of bids submitted for G.O.'s and revenues derived from regressions using pooled data. The regression coefficients for the same variables in the separate regressions are obviously quite different. Yet if the number of bids that would be submitted for revenues is estimated, using the means of the revenue variables and the G.O. regression, virtually the same estimate is obtained.[22]

II. The Relationship between the Number of Bids Submitted and the Difference between the Buying and Selling Prices of Underwriters

The preceding section of this paper dealt with the determinants of the number of bids submitted for an issue. In particular, the role of entry restrictions as a determinant of bids was investigated. Sections II and III study the effects of variations in the number of bids submitted upon the costs of underwriting services for the issuers of tax-exempts. In this section, the relationship of bids to spreads is investigated; in the next, the relationship of bids to reoffering yields is studied.

On average, the spread for G.O.'s is \$11.06 (for a \$1,000 bond), with a standard deviation of \$3.46 about this mean. By contrast, the spread for revenues is \$13.77, with a standard deviation of \$3.72. This existence of this difference, \$2.71, leads to a series of questions: To what extent is it attributable to differences, other than number of bids submitted, in the characteristics of the two classes of bonds? If not, to what extent do variations in the number of bids submitted account for the observed difference? And, how sensitive are underwriting costs to variations in the number of bids? Can bids be viewed as a proxy for competition?

[21] This is the bid category for which the comparative advantage for G.O.'s vis-à-vis revenues is greatest. Hence, the measured bid advantage for G.O.'s would have been larger had this category been included. However, this only widens the discrepancy to be explained. Three percent of revenues and 23 percent of G.O.'s are AAA on Standard and Poor's rating.

[22] At the means, the advantage is 0.71. Similarly, using the means of the G.O.'s and the revenue regression, the advantage is 1.2. If the end point for the "variable" time is used, which surely is more relevant for estimating what would happen if commercial banks were to be permitted to underwrite revenues, the bid advantage becomes 1.9.

The difference between the buying and selling prices, measured in dollars and cents, of tax-exempts is here viewed as a function of:

1. Quality as measured by Standard and Poor's rating; three dummies were entered for the top three rating classes, with the excluded set being BBB;
2. Issue size in thousands of dollars;
3. Volume of bonds already outstanding by the same issuers, measured in thousands of dollars, and entered linearly in logs;
4. Trend variable for underwriting costs of BBB-rated bonds;
5. Trend variables, for each of the top three rating classes, AAA, AA, and A, entered in weeks, with the excluded set being BBB, to measured trends in underwriting costs over time relative to BBB-rated bonds;
6. Interest rates, as measured by twenty-year White's yield for top quality bonds, observed weekly;
7. Change of interest rates; this week's less last week's White's;
8. First call date; noncallable bonds are regarded as callable at maturity, entered linearly in logs;
9. The number of bids submitted, entered linearly in logs;
10. A dummy for type of issue; "0" for G.O., and "1" for revenue issues;
11. Average maturity entered linearly in logs.

The results for the pooled samples of G.O.'s and revenues for which underwriters' spreads were available are displayed in table 4.

These results indicate that forty-eight cents of the observed difference of $2.71 in average underwriting costs is explained by the G.O.-revenue dummy. They also suggest that there exist economies of scale in underwriting; abstracting from bids, underwriting costs decrease with increases in issue size (table 4, row 1). There has been a downward trend in underwriting costs (rows 5 and 10). Abstracting from bids, issue size, etc., underwriting costs have decreased as a function of time.

Before turning to a discussion of the other variables, it is useful to segregate and examine the results of the separate regressions for each of the two classes of bonds. Clearly, bids, average maturity, rating, and White's (the yield of the highest-quality twenty-year tax-exempt) (table 5, rows 11, 6, 8, 3) play the most important roles in explaining variations in underwriters' spreads. The larger the number of bids submitted, the lower the underwriting costs. The fact that the relationship between bids and the underwriting costs is depicted better by a logarithmic than by a linear function suggests that the marginal effect of bids upon underwriting costs declines as the number of bids increases. Similarly, the fact that logs do better than a straight-line function (both were tried) in

TABLE 4

UNDERWRITERS' SPREAD REGRESSION:* COMBINED SAMPLE OF GENERAL OBLIGATIONS AND REVENUES

Independent Variables	Regression Coefficient	t-Value	Partial Correlation
1. Issue size	-0.31×10^{-4}	−10.0	−.12
2. Outstandings, in logs	-0.83×10^{-1}	− 7.0	−.08
3. Level of White's	3.7	27.0	.30
4. Change in White's	5.6	8.4	.10
5. Absolute trend of BBB	-0.60×10^{-2}	−10.0	−.12
6. Maturity, in logs	3.8	46.0	.47
7. Call dates, in logs	−6.5	− 6.7	−.08
8. Rating, Standard and Poor's:			
a) Underwriting costs of AAA relative to BBB	−3.0	−11.0	−.12
b) Underwriting costs of AA relative to BBB	−1.9	−10.0	−.12
c) Underwriting costs of A relative to BBB	−1.1	− 6.3	−.07
9. G.O.-revenue dummy	0.48	5.2	.06
10. Trends, in weeks:			
a) AAA relative to BBB	0.27×10^{-2}	2.5	.03
b) AA relative to BBB	-0.91×10^{-3}	− 1.2	−.00
c) A relative to BBB	-0.13×10^{-2}	− 2.0	−.03
11. Bids, in logs	−1.7	−27.0	−.30

* Number of observations, 7,532; G.O.'s, 6,137; revenues, 1,395. $R^2 = .55$; constant, −3.1; t-value, 5.9; residual variance, 6.1; standard error of estimate, 2.5. For some of the issues in the sample, underwriters' spread was unreported. Hence, the number of observations are fewer than the number used for the bid regression.

depicting the relationship between maturity and underwriting costs is consistent with the view that the marginal risk decreases as term-to-maturity increases.[23] These results support the view that the number of bids submitted can be viewed as a proxy for competition, that is, the larger the number of bids, the better off are the issuers.

The results obtained are also consistent with the usual view that underwriters have to be paid for risk bearing; the longer the average maturity, the greater the underwriters' risk and the greater the costs of underwriting an issue. Indeed, these results seem, on the surface, to be paradoxical. Underwriters have to be paid more for risk bearing than the ultimate investor. Underwriters charge more to hold low- vis-à-vis high-quality securities than the investing public; the higher yields of low-quality securities are sufficient inducement for the public to hold them. Yet, in a society in which resources are free to move around, one expects the most willing, that is, the cheapest, risk bearers to become underwriters.[24]

[23] For discussion of this point, see Kessel (1965, p. 49).

[24] Presumably, in the absence of any differences between underwriters and the investing public, underwriting costs would be the same for issues of all ratings. Differences in promised yields would capture differences in the marginal costs of underwriting securities of differing ratings unless marketing costs varied with rating.

TABLE 5

GENERAL OBLIGATION AND REVENUE REGRESSION:* UNDERWRITERS' SPREAD THE DEPENDENT VARIABLE

VARIABLES	REGRESSION COEFFICIENT		*t*-VALUE		PARTIAL CORRELATION	
	G.O.	Revenue	G.O.	Revenue	G.O.	Revenue
1. Issue size	-0.24×10^{-4}	-0.45×10^{-4}	− 7.1	− 6.6	−.09	−.17
2. Outstandings, in logs	-0.66×10^{-1}	−0.14	− 5.1	− 5.0	−.06	−.13
3. Level of White's	3.3	5.3	23.0	16.1	.28	.40
4. Change in White's	5.9	3.6	8.2	2.2	.10	.06
5. Absolute trend in BBB's	-0.62×10^{-2}	-0.79×10^{-2}	− 9.6	− 6.1	−.12	−.16
6. Maturity, in logs	4.0	3.3	43.0	15.6	.48	.39
7. Call dates, in logs	−0.65	-0.68×10^{-1}	− 7.6	− 0.44	−.10	−.01
8. Rating, Standard and Poor's:						
a) AAA/BBB	−3.1	−4.0	−11.0	− 3.3	−.14	−.09
b) AA/BBB	−1.8	−2.9	− 8.8	− 6.6	−.11	−.17
c) A/BBB	−0.96	−1.9	− 5.3	− 4.5	−.07	−.12
9. Trends, in weeks						
a) AAA/BBB	0.31×10^{-2}	0.25×10^{-2}	2.8	0.57	.04	.02
b) AA/BBB	-0.12×10^{-2}	0.23×10^{-2}	− 1.5	1.4	−.02	.04
c) A/BBB	-0.14×10^{-2}	0.85×10^{-3}	− 1.9	0.55	−.02	.01
10. Bids, in logs	−1.6	−2.1	−22.0	−14.0	−.28	−.36

* Revenues: R^2 = .52; constant, −4.9; *t*-value, 3.9; residual variance, 6.7; standard error of estimate, 2.6. G.O.'s: R^2 = .52; constant, −2.4; *t*-value, 4.1; residual variance, 5.8; standard error of estimate, 2.4.

This paradox can be resolved if one recognizes that the security of any particular issuer constitutes a smaller fraction of the portfolio of the investing public than it does for underwriters; underwriters, unlike the investing public, forego diversification. Hence, at the margin, the same security is more risky for the underwriter, and this difference is a function of the quality of the marginal security. The lower the quality, the larger the difference. Consequently, AAA G.O.'s are estimated to cost about $3 less to underwrite than BBB G.O.'s; AA G.O.'s, about $2 less; and A's, about $1 less. For revenues, the corresponding figures are $4, $3, and $2. The trend variables suggest that underwriting costs have been going down over time, with the highest-quality bonds decreasing the least (see table 6).

The downward trend in underwriting costs, which is strongest for the lowest-quality securities, is consistent with the view that the payment for holding low- vis-à-vis high-quality bonds has been decreasing. This implies that the economic significance of quality differences must be decreasing and the substitutability between low- and high-quality bonds has been increasing.

Secularly, there has been a positive trend in interest rates and a negative trend in underwriting costs. Yet, cyclically, underwriting costs are positively related to rates. This positive cyclical relationship of underwriting costs to interest rates has the same explanation as the positive cyclical relationship of number of bids to interest rates. About cyclical peaks, commercial banks, which hold about 40 percent of all tax-exempts outstanding, are more likely to be sellers than buyers.[25] Hence, new buyers must be found for tax-exempts coming to market at such times, and it is likely that underwriting costs rise as a consequence.[26] Second,

TABLE 6

DECREASE IN UNDERWRITING COSTS*

Rating	General Obligations	Revenues
AAA.....	$1.29	$2.25
AA.....	3.08	2.35
A.....	3.16	2.92
BBB.....	2.50	3.28

* In dollars and cents per eight-year span.

[25] Investment Bankers Association of America (1968, p. 25).

[26] Morris Mendelson (1968, p. 223), suggests that the difference in underwriting costs between G.O.'s and revenues may be attributable to differences in transactions size for these two classes of bonds. He contends that the market for G.O.'s is more institutionalized than revenues, that is, commercial bankers buy more G.O.'s than revenues for their own portfolios, and the average transaction size for commercial banks is greater than it is for the market as a whole. Accepting Mendelson's empirical statements, one would expect underwriters' costs for G.O.'s to be more sensitive than

although there has been a secular trend downward in yield differentials between low- and high-quality bonds, these differentials increase during expansions and narrow during contractions. This cyclical pattern implies high-yield differentials at interest-rate peaks, which, during the post-World War II period, have been associated with business peaks, and low differentials at interest-rate troughs, which have been associated with troughs in business conditions. Moreover, the cost of "carrying" bonds is a function of the level of rates.

The relationship of interest-rate changes to changes in underwriting costs indicates that underwriting costs rise when interest rates are rising and conversely. This is an alternative to saying that if bond prices are falling, underwriting costs are rising. Since underwriters buy before they sell, this is not an unexpected result, assuming they have expectations about future rates that are to some degree correct. Costs of underwriting, in fact, rise when rates rise or bond prices fall.

The costs of underwriting G.O. bonds are increased by call provisions. Yet, there appears to be no difference in the underwriting costs of callable and noncallable revenues. This is consistent with a higher probability of par calls for callable G.O. bonds than callable revenue bonds. Hence, the call feature of G.O.'s is regarded as more disadvantageous than the call feature in revenues. This is reflected in relatively higher underwriting costs for callable G.O.'s, whereas the same is not true of revenues.[27]

The regressions presented (table 4, row 11) show that number of bids is inversely correlated with underwriting costs. They also indicate that the marginal value of bids to the issuer decreases as the number of bids increases. (Number of bids is entered linearly in *logs* of number of bids.) However, no evidence is presented to indicate at what number of bids the value of the marginal bid falls to zero. To achieve this end, the independent variable, bids, is replaced in the regressions reported in tables 4 and 5 with eleven dummy variables. These dummies represent one through eleven bids, and the excluded set consists of issues receiving twelve or more bids. In other words, the question is being asked: Is there a significant difference in the underwriting costs between one bid and all bids over eleven, two bids and all bids over eleven, etc.? Since there was

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revenues to the level of interest rates. Since banks are out of the market as buyers of tax-exempts about interest-rate peaks, Mendelson's empirical propositions imply that underwriting costs for general obligations should be more sensitive to the level of rates than the underwriting costs for revenues. The regressions in table 5—more specifically, the coefficients associated with the level of rates—suggest that underwriting costs for G.O.'s are the less sensitive of the two classes of bonds.

[27] Charlotte D. Phelps (1961, pp. 284–85) argues that a maturity date known with certainty commands a lower rate of interest than a maturity date with uncertainty. Callability imposes upon the investor the additional risk of having to liquidate at a time when he can reinvest only at a lower yield. Here, empirical findings for a combined sample of revenues and G.O.'s confirm this analysis. She does not recognize that there could exist premiums for call provisions that would vitiate her analysis.

virtually no change in the results for the other variables in these regressions, only the findings for the dummies are reported (see table 7). Additional bids clearly have a positive marginal product in terms of reducing underwriting costs through six bids for revenues and nine for general obligations; thereafter, the effects of bids on costs is much more ambiguous. The dummies also show why logs provide a better fit than a linear function; the marginal product falls off sharply as bids increase. Nevertheless, these findings indicate that an increase in the number of bids submitted for revenues (the mean is 4.81) would reduce underwriting costs.

III. The Relationship between the Number of Bids Submitted and the Selling Prices or Reoffering Yields of Underwriters

The evidence presented above showing that underwriters' spreads decrease with number of bids suggests that the prices received by issuers of tax-exempts increase as the number of bids increases if either no changes occur in the terms at which the ultimate investor buys bonds as bids increase or reoffering prices increase with bids. This section will present evidence that shows that selling prices increase as bids increase. Hence, as the number of bids increases, the difference between buying and selling prices of underwriters decreases and the selling prices of underwriters increase. For the issuers of tax-exempts, these effects are additive; both operate to reduce the costs of borrowing.

Those who have speculated about the effect of number of bids upon reoffering yields have typically concluded that no relationship exists.

TABLE 7

UNDERWRITING COSTS AS A FUNCTION OF BIDS*

	UNDERWRITING COSTS			*t*-VALUES		
BIDS	Combined Sample	G.O.	Revenue	Combined Sample	G.O.	Revenue
1.....	5.74	5.09	6.32	21.8	15.7	10.0
2.....	2.64	2.50	2.73	16.7	13.9	5.2
3.....	2.36	2.33	2.38	17.2	15.6	4.7
4.....	1.63	1.69	1.38	12.5	12.2	2.7
5.....	0.99	0.95	1.12	7.9	7.2	2.2
6.....	0.71	0.72	0.58	5.7	5.5	1.1
7.....	0.52	0.51	0.49	4.0	3.8	0.9
8.....	0.34	0.29	0.60	2.4	2.0	1.1
9.....	0.12	0.13	0.10	0.9	0.85	0.2
10.....	0.23	0.18	0.54	1.4	1.06	0.9
11.....	0.11	0.13	−0.21	0.6	0.73	−0.3

* More precisely, the mean difference in underwriting costs between the mean costs for each number of bids and for all bids over eleven, measured in dollars and cents.

For example: "The offering price to the public, however, depends basically on the quality rating, the maturity, and other characteristics of the bonds being offered as well as the state of the market at the time of offering. These are the prime determinants of investment demand at a given time. An increase in the number of competitors in the sense of an increase in the number of underwriting groups bidding for the issue, does not alter these basic determinants of the public offering price."[28] By contrast, the work of West suggests that reoffering yields should fall as the number of bids submitted increases.[29]

In order to produce evidence bearing on the relationship between bids and reoffering yields, other variables that affect reoffering yields are introduced in order to isolate the effect of variations in bids. The excess of the reoffering yield of the twenty-year maturity of all new issues over White's is used as the dependent variable. Hence, both variations in the level of interest rates when bonds are reoffered and variations in rates attributable to maturity differences are held constant. The other variables introduced to isolate the effect of variations in bids are issue size, outstanding bonds of the same issuer, rating, call provisions, and trend. (Average maturity is introduced as an independent variable to determine whether in fact it has been held constant.) Outstandings, maturity, and call provisions are included linearly in log form; the ratings and trend variables, in the form of dummy variables. The market interest rates are measured by White's in order to isolate the effects of variations in the market rate on the spreads between top-quality yields and actual yields on new offerings, the dependent variable in the regressions presented in this section of this study.[30] A G.O.-revenue dummy variable is used to measure how much of the difference in reoffering yields between these

[28] Fox (1963, pp. 720–21).

[29] See West (1965*a*, p. 135). Insofar as West is correct, it follows that interest costs to issuers decrease as numbers of bids increase for two reasons. These are the decrease in underwriters' spread and the increase in reoffering prices, or, to use a slightly different language, the fall in reoffering yields. From the point of view of the issuers of tax-exempts, these gains from competition are additive.

[30] The rationale for the expectation of a positive correlation between the difference in yields of bonds of different quality with the level of interest rates may be found in Kessel (1965, p. 85). Briefly, the argument is: The substitutability of a security for money is a function of the variance in its realized rate of return. By this criterion, low-quality bonds are poorer money substitutes than high-quality bonds. Hence, when the level of rates rises and the costs of holding money and money substitutes rise, the yield differential between low- and high-quality bonds ought to increase also. Therefore, yield differentials associated with quality differences ought to be positively related to the level of rates. The change in White's, this week's less last week's rate, is not employed as an independent variable, unlike the underwriters' spread regressions, in the reoffering-yield regressions. The rate of change in rates affects the cost of carrying bonds; however, it should not affect the difference between reoffering yields and White's. By the argument in the preceding paragraph, it should affect the rate of change of the reoffering yield less White's.

two classes of bonds remains unexplained. The results obtained are displayed in table 8.

These results show that reoffering yields go down as number of bids increases. Hence, the change in reoffering yields is additive to the change in underwriting spreads for computing the gains to be derived from additional bids for the issuers of tax-exempt bonds. The G.O.-revenue dummy (.086) indicates that less than half of the average difference in reoffering yields, fifteen basis points, is explained by the variables considered. In this respect, the results obtained appear to be roughly consistent with the findings for underwriting spreads.

The separate regressions exhibit trends which imply a compression in yield differentials as a function of time (table 9). This compression can be seen a little more clearly by converting the data from relative to absolute changes and examining the eight-year period as a whole (see table 10). These findings clearly show that there has been a compression in yield differential attributable to quality differences as a function of time. What has been observed indicates that there has been a secular trend in these differentials over the post–World War II period.[31]

TABLE 8

COMBINED SAMPLE OF GENERAL OBLIGATIONS AND REVENUES:* REOFFERING LESS WHITE'S, THE DEPENDENT VARIABLE

Variable	Regression Coefficient	t-Value	Partial Correlation
Issue size	-0.14×10^{-5}	− 5.9	−.07
Outstandings, in logs	-0.41×10^{-2}	− 4.8	−.06
G.O.-revenue dummy	0.86×10^{-1}	13.0	.16
White's	0.18	19.0	.23
Absolute trend of BBB's in weeks	-0.95×10^{-3}	−26.0	−.30
Maturity, in logs	0.12×10^{-1}	1.5	.02
Rating:			
1. AAA/BBB	−0.61	−27.0	−.32
2. AA/BBB	−0.46	−35.0	−.40
3. A/BBB	−0.24	−21.0	−.25
Bids, in logs	−0.14	−31.0	−.36
Call provisions, in logs	-0.48×10^{-1}	− 8.6	−.11
Trends, in weeks:			
1. AAA/BBB	0.78×10^{-3}	9.2	.11
2. AA/BBB	0.48×10^{-3}	9.4	.12
3. A/BBB	0.17×10^{-3}	3.8	.05

* 6,503 observations: 1,279 revenues; 5,224 G.O.'s. The only reason for the difference in the number of observations in the underwriters' spread regression and this one is the failure of many issues to have a maturity as long as 20 years. Constant, 0.53; t-value, 12.7; $R^2 = .64$; residual variance, 0.03; standard error of estimate, 0.16. For those with a taste for high R^2s, this taste can be satisfied by running this regression with reoffering yields alone as the dependent variable.

[31] This suggests that it would be undesirable to relate reoffering yields to an index of bond yields or bond prices when this index reflects yields of bonds of varying quality. The *Bond Buyer* index is indeed such an index; it consists of bonds that range in quality over most of the quality spectrum.

TABLE 9

REOFFERING YIELDS LESS WHITE'S:* GENERAL OBLIGATIONS COMPARED WITH REVENUES

VARIABLES	REGRESSION COEFFICIENT		*t*-VALUE		PARTIAL CORRELATION	
	G.O.	Revenue	G.O.	Revenue	G.O.	Revenue
Issue size	-0.14×10^{-5}	-0.15×10^{-5}	− 5.5	− 2.5	−.08	−.07
Outstandings, in logs	-0.30×10^{-2}	-0.63×10^{-2}	− 3.2	− 3.2	−.04	−.09
White's	0.15	0.29	14.0	12.8	.19	.34
Absolute trend of BBB's in weeks	-0.99×10^{-3}	-0.94×10^{-3}	−24.0	−10.8	−.32	−.29
Maturity, in logs	-0.16×10^{-2}	0.12×10^{-1}	− 0.17	0.62	−.00	.02
Rating:						
1. AAA/BBB	−0.61	−0.81	−27.0	− 6.3	−.35	−.17
2. AA/BBB	−0.46	−0.45	−32.0	−14.6	−.41	−.38
3. A/BBB	−0.25	−0.21	−20.0	− 7.3	−.27	−.20
Bids, in logs	−0.14	−0.16	−27.0	−15.7	−.35	−.40
Call provisions, in logs	-0.76×10^{-1}	0.16×10^{-1}	−12.0	1.4	−.16	.04
Trends, in weeks:						
1. AAA/BBB	0.83×10^{-3}	0.11×10^{-2}	9.6	2.5	.13	.07
2. AA/BBB	0.54×10^{-3}	0.33×10^{-3}	9.6	2.7	.13	.08
3. A/BBB	0.22×10^{-3}	0.77×10^{-4}	4.4	0.74	.06	.02

* For revenues: $R^2 = .60$; constant, 0.25; *t*-value, 2.7; residual variance, 0.03; standard error of estimate 0.17. For G.O.'s: $R^2 = .63$; constant, 0.70; *t*-value, 14.9; residual variance, 0.03; standard error of estimate, 0.16.

TABLE 10

CHANGE IN REOFFERING YIELDS RELATIVE TO WHITE'S (DUE TO TREND)*

Rating	General Obligations	Revenues
AAA.....	− 7	+ 5
AA.....	−19	−25
A.....	−32	−36
BBB.....	−41	−37

* Measured in basis points per eight-year span.

Another way to observe the effect of number of bids on reoffering yields is to employ a series of dummies for bids as an alternative to entering bids as a continuous variable in the foregoing regressions. By using eleven dummies for bids from one through eleven, differences in reoffering yields between (*a*) yields on issues with any specified number of bids ranging from one through eleven, and (*b*) yields on issues with twelve or more bids, are compared. If significant differences exist, these would be evidence on the sensitivity of reoffering yields to bids (see table 11). Up to but not including seven bids for revenues and eleven for G.O.'s, the means seem to be significantly different. Hence, the seventh bid for revenues and the eleventh for G.O.'s seem to produce positive marginal products, that is, lower costs for issuers. Beyond these two points, the value of additional bids is more doubtful.

These results lead to the conclusion that it is not true that the "market" determines reoffering yields and the degree of competition among underwriters affects underwriters' spreads only. In this respect, the find-

TABLE 11

REOFFERING YIELDS LESS WHITE'S AS A FUNCTION OF BIDS*

Number of Bids	Combined Sample		General Obligations		Revenues	
	Difference in Means	*t*-Value	Difference in Means	*t*-Value	Difference in Means	*t*-Value
1.....	37	20.3	34	15.1	40	9.5
2.....	24	20.8	25	18.6	26	7.1
3.....	20	20.0	21	19.3	21	6.0
4.....	15	15.3	16	15.4	15	4.2
5.....	10	10.6	10	10.3	14	4.0
6.....	6	6.9	7	7.5	7	1.9
7.....	4	4.2	5	4.9	4	1.0
8.....	4	3.6	4	3.5	8	2.1
9.....	3	2.4	3	2.6	5	1.1
10.....	2	1.7	3	2.3	1	0.2
11.....	2	1.4	2	1.4	4	0.8

* In basis points, differences in reoffering yields less White's for bids 1–11 compared with differences in reoffering yields less White's for all bids 12 and over.

ings reported here are consistent with the results obtained by West, who used a substantially different method of analysis for arriving at the same conclusion.[32] West explained the decrease in reoffering yields with number of bids by invoking monopoly theory. He argued that there exists collusion among underwriters that limits the number of bids submitted for large issues. The gains from collusion are taken in the form of purchases at the reoffering by members of the conspiracy who are not members of the bidding syndicate and by purchases for their own account—that is, not reoffering to the public—by syndicate members. In other words, West contends that reoffering yields for issues receiving one and to a lesser extent two bids are fictitious yields in the sense that they are not available to the investing public. At the quoted reoffering yields of the syndicate, there exists nonprice rationing, and those in the conspiracy preempt the issue. After the syndicate has dissolved, the conspirators reoffer their bonds at prices higher or yields lower than the original reoffering.[33]

An alternative explanation of the relationship of reoffering yields to number of bids submitted, which is not necessarily competitive with West's, is suggested by Stigler's economics of information.[34] Underwriters possess specialized knowledge of what the customers they serve will pay for a prospective bond issue. This knowledge of customer preferences, that is, knowledge of the "market," is not the same for all under-

[32] West (1965*a*) examines the differences between the yields of new and seasoned issues of the same issuer. He used the dummy-variable technique also; however, he defined his excluded class to be the population of over three bidders. The findings presented here suggest that West may have inappropriately defined his excluded class. If the excluded class included bids that have positive marginal effects upon reoffering yields, then the probability of detecting differences between the bid categories explicitly considered is lower than it would be if the excluded class constituted a narrower range of bids. West found a range of about twelve basis points going from one to the maximum number of bids he considered. This is about one-third the range observed here. However, this is probably not the most likely explanation of the difference in findings. West's benchmark, yields of already outstanding bonds of the same issuer, is more likely to be affected by the appearance of a new issue than is the yield reported by White.

[33] This does not explain, nor does West explain, why monopoly gains are not incorporated into underwriters' spreads.

[34] Stigler (1961, p. 213). This explanation has other implications that are consistent with the findings presented here. If one accepts the empirical judgment that the "broadness" of the market for tax-exempts is a positive function of quality, with broadness measured by the set of holders of tax-exempts in each of the quality categories, then it follows that the economic resources going into search by underwriters ought also to be a function of the quality of the issue to be distributed. The variation in number of bids submitted with rating, shown by the bid regressions presented earlier, is consistent with this interpretation. Similarly, the trend in bids over time as a function of quality implies, if one accepts the search hypothesis, that the market for high-quality bonds is broadening relative to low-quality bonds. In addition, this hypothesis implies that low-quality bonds will be overrepresented among issues not submitted for competitive bids, that is, negotiated.

writers; their knowledge of the preferences of their "good" customers is better than their knowledge of the preferences of indifferent or poor customers. This knowledge of the market, which is not known to any underwriter in its totality, is incorporated in the prices offered to issuers by underwriters when bids are submitted. Consequently, the larger the number of bids submitted, the greater the probability of discovering the underwriter in possession of the knowledge of who will pay the most for a prospective issue; this is apt to be the underwriter who submits the winning bid. Reoffering yields decline as bids increase, because bids constitute search by issuers for those buyers who most prize the bonds they have to sell. This search is intermediated by underwriters; and the more extensive the search, the higher the price realized.

The foregoing interpretation of the behavior of reoffering yields with respect to bids implies that knowledge of the "market" for tax-exempts is what the issuers of tax-exempts buy when they engage the services of underwriters. This knowledge consists of knowing who will buy and at what price tax-exempts of a given rating, call provision, issuer, maturity, etc., at a particular moment in time. Underwriters pit knowledge of this type against one another when they compete for new issues. This process constitutes a means for searching the market for those buyers for whom a particular issue will be the most valuable.

This dimension of competition among underwriters appears to overshadow all other aspects of competition among underwriters, including those that have been typically emphasized—such as risk bearing, marketing, etc. This view can be supported by comparing the range of underwriters' spreads as a function of bids with the comparable range for reoffering yields. Reoffering yields have a range of $3.40 for G.O.'s and $4.00 for revenues per $1,000 bond per year. (One basis point is equivalent to ten cents in servicing costs per bond per year.) Discounting at a 5 percent rate, which is a very high rate for tax-exempts during the period under investigation, variations in capital costs of from $34.00 to $40.00 are implied for a bond issue with a fifteen-year average life. This is about six times the range for underwriters' spreads. Hence, even if one imputes all of the variation in underwriters' spreads to other aspects of competition among underwriters, for the issuer the search effect is dominant.

The reoffering-yield regressions show that those who have argued that ratings are an incorrect measure of the quality of a bond because one can observe bonds of the same quality rating with different reoffering yields have used an inappropriate argument.[35] Clearly, reoffering yields are

[35] West (1967, p. 249). Lack of continuous variability is a more appropriate argument which West also makes. The findings here suggest that West's use of reoffering yields to measure quality and therefore a determinant of underwriters' spreads along with bids, issue size, etc., constitutes a misspecified model. Reoffering yields and underwriters' spreads are highly correlated because they are determined by virtually the same variables.

affected by a number of variables wholly or largely independent of quality (that is, default risk), such as callability, number of bids, and issue size.[36] Hence, although the conclusion that ratings are less than perfect may be correct, and probably is, a more sophisticated analysis is required to establish this point.

The investigations of the comptroller of the currency and the Federal Reserve into the effects of increased competition upon underwriting costs have largely ignored the relationship between reoffering yields and number of bids, and focused on the relationship of (1) underwriters' spreads, and (2) the so-called net interest cost to number of bids submitted.[37] The latter relationship is difficult to interpret because the meaning of net interest cost is not economically "sensible." Net interest cost is the criterion by which the lowest bidder is selected in the United States. It is a function of the coupons assigned to a prospective bond issue by underwriters. When a tax-exempt issue is put out for bids, each bidder assigns coupons to every maturity of the issue. (Most tax-exempt bond issues are serial bond issues, that is, have multiple maturities.) The net interest cost is determined by computing the total prospective costs of servicing and dividing by the weighted average maturity. In other words, the undiscounted expenditure stream for servicing is summed and divided by the average amount to be borrowed to determine net interest cost.[38]

The net interest cost method of computing the costs of servicing a bond issue implies that a dollar to be disbursed in the distant future is just as important as a dollar in the near future. To see that this is the case, assume that the same amount of a serial bond issue falls due on every maturity date. Then, if the coupon is reduced from, say, 5 to 4 percent for the ten-year maturity and the coupons for the four- and six-year maturities are increased from 4 to 5 percent, computed net interest cost remains unchanged. However, the present worth of the servicing costs has increased. Hence, this method for evaluating bids leads underwriters to assign high coupons to short, and low coupons to long, maturities. For

[36] Mendelson (1967, p. 426) asserts, without documentation, that yield is a more accurate measure of quality than rating. One suspects that the author regards this statement as so obviously true that documentation is redundant. If quality is defined to be default risk, and not reoffering yield, then the case that rating is a poorer measure than reoffering yield is far from obvious.

[37] Heins (1962, p. 399); West (1966, p. 305); and Phelps (1961) estimate net interest costs only. The difference, perhaps the chief difference, between West's regressions and the others is that Heins and Phelps ignore bids as an independent variable.

[38] Often, last-minute adjustments in bids of underwriters are made by offering to pay an amount in excess of the par value of the securities in cash. This is often done as an alternative to adjusting coupons. Amounts in excess of par value paid by underwriters are deducted from the total expenditure stream to be paid in servicing bonds in computing net interest cost.

underwriters to respond in any other way would be economic suicide. Consequently, the long-term maturities of most serial bond issues with multiple coupons are reoffered by underwriters at less than par; and the short terms, at premiums. Since the bonds of a new issue are in aggregate sold at par, the difference between the reoffering price and the value at maturity is taxable income. These "capital gains," really implicit interest, for the buyers of long terms are taxable as capital gains, whereas the explicit interest is tax free. Hence, some of the tax exemption of municipals is dissipated.[39] Alternatively, the cost of servicing tax-exempts is higher than it would be if a method of evaluating bids were used that led to the reoffering of tax-exempts at par.

These findings also indicate that if one abstracts from the trend in differentials over time, yield differentials between White's and any specified rating class are related positively to the level of interest rates. However, the reoffering-yield regressions do not, and cannot, show what happens to the differentials in reoffering yields caused by rating differences as the level of interest rates varies. To investigate the sensitivity of these differentials to the level of rates, the coefficient of White's was computed for each rating class.[40] If these differentials are sensitive to the level of rates, this sensitivity will be revealed by differences in the magnitude of these coefficients. The coefficients (see table 12) clearly show that differentials increase, after abstracting from trend, with the level of rates.

These findings are consistent with the implications of the money-substitute theory of securities, or the theory of liquidity preference, enunciated by Hicks (1962). Low-quality bonds are subject to greater default risk than high-quality bonds. Hence, the variance in the realized rate of return from holding low-quality bonds is greater. Consequently, they are poorer substitutes for money than high-quality bonds. Since high-quality bonds are better money substitutes, and the opportunity cost of holding money and money substitutes ought to increase simulta-

[39] The market for long-term tax-exempts, selling well below par, tends to be confined to life insurance companies. Capital gains is not included in the definition of life insurance company taxable income (see Percus and Quinto 1956, p. 415, n. 2). Also, Robinson (1960, p. 233, n. 3) reports that the low-coupon terminal maturities are usually not reoffered publicly. However, underwriters report that the yield-to-maturity of these maturities is usually from forty to sixty basis points higher than a comparable maturity reoffered at par. There exists a difference of opinion in the literature on what the foregoing article contains. West (1966, p. 113, n. 12), says: "The article [by Percus and Quinto] also failed to recognize the difference between 'present value' methods of interest computation and the traditional form prevailing in this bidding." Percus and Quinto regard (1956, p. 415) the reoffering yields as "determined by market conditions." Reoffering yields are assumed to be exogenously determined and regarded as given in solving for an optimal pattern of coupons.

[40] More specifically, the coefficient of White's for each rating class relative to the coefficient of BBBs was computed in addition to computing the absolute value of the coefficient for BBBs.

TABLE 12

COEFFICIENTS OF WHITE'S BY RATING CLASS*

Rating	General Obligations	Revenues
AAA.....	−0.07	0.05
AA.....	0.02	0.09
A.....	0.15	0.20
BBB.....	0.27	0.27

* These coefficients measure the sensitivity of the difference between reoffering yields and White's to the level of White's. The sensitivity of reoffering yields to White's is measured by one plus the coefficients in table 7.

neously, yield differentials associated with quality differences should increase with the level of rates if the Hicks's theory is correct.[41]

IV. Analysis of Saxon General Obligations

In comparison with the data already utilized, the Saxon G.O.'s represent a handful of issues. Hence, if these issues constituted evidence with the same strengths and weaknesses as that already presented, their marginal value here would be nil. The great merit of the Saxon G.O. evidence is: it is a test case of what would be the immediate, if not the long-run, effects of the abolition of the prohibition of bank underwriting of revenue bonds. Because of the abundance of evidence on the relationship of reoffering yields and underwriters' spreads to number of bids, the question asked of the Saxon G.O. data is: Did the number of bids increase as a result of the partial lifting of the ban against bank underwriting of revenues as a result of Saxon's rulings?[42]

For every issuer whose bonds were affected by Saxon's rulings, an attempt was made to compare the number of bids submitted for postruling issues with bids for the immediately preceding preruling issues. Issues following rulings were paired, insofar as possible, with an equal number of issues preceding rulings. If there were, for example, two issues after Saxon's ruling for an issuer, then these two issues were paired with the two issues that just preceded the ruling, subject to the constraint that these issues have the same Standard and Poor's rating.

[41] Hickman (1958, pp. 288 ff.) observed that quality differentials for corporates are also a function of the level of rates. However, he used a wholly different theory to explain his observations. Phelps (1961, pp. 301–2) also finds that yield differentials increase with the level of rates.

[42] These rulings occurred between 1962 and 1966. Another body of data similar to the Saxon G.O.'s will be generated by recent legislation. An amendment to a housing law passed in 1968 makes all bonds issued to finance state university dormitories eligible for bank underwriting. Hitherto, such bonds have been regarded as revenues.

Such a comparison involves obvious difficulties unless one abstracts from other factors that determine the number of bids—such as, issue size, level of interest rates, rate of change of rates, etc.—the variables that were considered in the analysis of bids. The matching process is best for holding quality, the single most important determinant of the number of bids uncovered here, constant. In general, issue size, the level of rates, and outstandings have increased as a function of time. The bid regressions suggest that, on balance, ignoring these variables will bias the comparison against discovering more bids for the post-Saxon issues. Nevertheless, this evidence indicates that the number of bids submitted for post-Saxon ruling issues, on average, exceeded the number submitted for pre-Saxon issues by a factor of 50 percent. Moreover, about half of the bonds affected by Saxon ruling were bid for and won by syndicates led by commercial banks.

There are thirteen issuers for which there were just one pre-Saxon and post-Saxon issue. For this set, two issues received the same number of bids before and after rulings. Three received fewer bids, and eight received more bids after becoming eligible for bank underwriting. Of the three issuers for which two issues were involved, all three issuers received, on average, more bids for post-Saxon issues. The same holds true for issuers with four, five, seven, and eight paired issues. Of the twenty-one issuers of Saxon G.O.'s, three received fewer bids, two the same, and sixteen more bids after Saxon's rulings. Of the forty-six issues studied, there were, on average, in excess of four bids after issues became Saxon G.O.'s in contrast with under three bids when they were defined to be revenues. Table 13 constitutes a listing of the issuers and a summary of the number of bids received by each issuer for the issues compared.

V. Conclusions

The results obtained indicate that the prohibition of bank competition in the underwriting of revenue bonds has led to fewer bids for these bonds and higher underwriting costs. In particular, the issues of revenues that are high quality, short maturity, and offered about troughs in business conditions have been particularly disadvantaged.

Competition in the tax-exempt bond market manifests itself principally through its effects on the terms at which bonds are bought by the investing public. Competition is search; the greater the degree of competition, the more the market is searched by underwriters for buyers. Consequently, the greater the degree of competition, the more extensive the canvass of the market and the higher the prices received by underwriters. Interpreting the results obtained with the aid of Stigler's search hypothe-

TABLE 13

SAXON GENERAL OBLIGATIONS*

Issuers	Pre-Saxon Bids	Post-Saxon Bids
Single issues:		
1. Alabama Public School and College Authority	2	3
2. Detroit Wayne Joint Building Authority	3	3
3. Florida State Board of Education†	2	3
4. Georgia Ports	9	7
5. Georgia State Hospitals Authority	4	9
6. Georgia State Office Building	8	7
7. Georgia Stone Mountain Memorial	5	7
8. Illinois State Office Building	4	4
9. University of Texas—Board of Regents	9	6
10. Georgia Rural Roads	4	13
11. Port of New York Authority	4	5
12. Indiana State Office Building	2	3
13. Wisconsin State Agencies	4	5
Two issues:		
1. Georgia State School Building Authority	4	8
2. Georgia State Highway Authority	8	19
3. Louisiana Capital Construction and Improvement Commission‡	5	8
Three issues:		
State of Washington Public School Plant Facilities Bonds†	7	11
Four issues:		
Ohio Highway Improvement and Major Thoroughfare Bonds†	8	16
Five issues:		
Pennsylvania Highway and Bridge	12	21
Seven issues:		
Pennsylvania State Public Schools Building Authority	13	31
Eight issues:		
Pennsylvania Generals	16	29
Totals	133	218

* All issues were either AA or AAA as rated by Standard and Poor's.

† Reverted to revenue status in 1967 and received two bids on January 24, 1967.

‡ Reverted to revenue status on March 14, 1967 and received three bids.

sis, the bid regressions can be viewed as supply equations, with the number of bids submitted being affected by the size of the market at the time an issue is submitted for competitive bids; the economic profitability of search is a function of market size. On this analysis, there appears to be a trade-off, with respect to search, between a small number of large syndicates and a large number of small syndicates. This suggests that the negative coefficient of issue size in the reoffering-yield regressions is a consequence of bids not measuring a homogeneous unit of search. The larger the issue, the larger the syndicate and conversely. However, the question of what constitutes a better measure of search, and how it ought to be employed, goes well beyond the scope of this paper.

Finding that revenue issues do indeed receive fewer bids than G.O.'s leads to the question: Why should the prohibition of bank underwriting

of revenues imply less competition in revenue than in G.O. underwriting? There exist no entry barriers to the underwriting of revenues for other participants or would-be participants in our financial markets; free entry exists for all except commercial bankers.[43] Hence, the level of competition in underwriting revenue bonds ought to be unaffected by the absence or presence of commercial bankers in this market.[44] This line of analysis is based on certain premises about the supply function of underwriting capital and talent which may not be appropriate. Certainly, many would argue that the salaries of professors would be higher if one or another cultural group that has demonstrated survival properties in higher education were excluded by a legal prohibition. Hence, long-run supply inelasticities cannot be ruled out as an answer.

However, there does exist another line of explanations of the results obtained here that does not rest upon supply inelasticities. This is the argument that investment and commercial bankers are complementary resources in producing underwriting services. This complementarity in production stems from the differences in the laws regulating these two classes of enterprises. To the extent that the costs of distribution of financial securities are subject to economies associated with being able to offer a "full line" of securities to the market, investment bankers can distribute more economically than commercial bankers. Typically, investment bankers distribute more than tax-exempts; they also distribute corporate bonds and stocks. By contrast, commercial bankers are precluded from the latter markets by law.

With respect to financing the holdings of inventories of tax-exempt securities in the process of distribution, commercial banks can take the income on these securities as tax free. By contrast, investment bankers can take this income as tax free, subject to an important constraint, that tax-exempts are not used to secure loans. In other words, the value of tax-exempts as collateral is less for investment bankers than it is for commercial bankers. Or, commercial banks have a comparative advantage in carrying tax-exempts.[45]

An implication of this analysis is that syndicates bidding for bonds that both investment and commercial bankers are eligible to underwrite

[43] Mendelson (1967, pp. 425–26) seems to regard the prohibition of bank underwriting of revenues as ipso facto evidence of less competition in revenue relative to G.O. bond underwriting.

[44] A related question is: What would happen to the cost of transacting in federal government securities if banks were barred from this market? Currently, both investment and commercial bankers deal in governments, and no legal entry barriers exist for anyone.

[45] Investment bankers have a strong incentive to pledge anything but tax-exempts to secure bank loans. As a consequence, investment bankers that underwrite tax-exempts exclusively have become a smaller fraction of the market as a function of time.

will consist of both investment and commercial bankers. This implication appears to be correct. Whenever it is possible, in the case of general obligations, syndicates formed to submit bids to buy and distribute tax-exempts usually consist of a combination of both commercial and investment bankers. Moreover, syndicates that underwrite G.O.'s almost invariably allocate to their commercial bank membership the task of carrying undistributed bonds.

Trend was entered into several of the regression equations and was euphemistically referred to as a variable. Clearly, it must be a proxy for an unspecified variable. The trend in bids, which is strong enough to account for an increase in roughly two bids per issue over the period studied, manifested itself in the bid regression for G.O.'s only. Hence, any explanation offered must be specific to G.O.'s or irrelevant for revenues. If the value of this tax advantage is a function of the level of interest rates, this would explain the upward trend in bids, since there has been an upward trend in rates over the time period investigated.

Why should the advantage of banks in carrying tax-exempts be a function of the level of rates? A rise in interest rates increases the difference between tax-free income and deductible expenses. Hence, assuming a constant marginal tax rate for banks over the time interval studied and no change in the ratio of tax-exempt rates to short-term rates such as bill rates (which are relevant for measuring the cost of short-term funds), this conclusion follows. To illustrate, assume that the short-term rate, which measures the implicit interest cost of deposits for banks, is 3 percent and goes to 6 percent, while the tax-exempt rate goes from 2 to 4 percent. The difference in the after-tax income at the beginning of the period, assuming a marginal tax rate of 50 percent, is the difference between 2 and 1.5 percent. At the end of the period, it is the difference between 4 and 3 percent.[46] By contrast, the losses of investment bankers, if they pledge municipals for loans, increase with the level of rates insofar as the difference between tax-exempt and short-term taxable rates widens. Another avenue for explaining the trend in bids for G.O.'s, which is not inconsistent with the tax argument, is the growth in the holdings of tax-exempts by commercial banks as a function of time. The *Federal Reserve Bulletin* (1967) reports that the holdings of tax-exempts by commercial banks grew from about 8 to about 13 percent of loans and investments between the end of 1958 and the end of 1967. If commercial bank underwriters are overrepresented in servicing commercial banks as investors in tax-exempts, as was argued earlier, then the trend in bids can be rationalized as a consequence of the growth in the market served by commercial bank underwriters.

[46] In fact, the ratio of tax-exempt rates to short-term taxable rates has risen over this time period. Hence, the foregoing example understates the improvement over time in the tax advantage of banks in carrying municipals.

The trend in underwriting costs and reoffering yields, the other trend "variable" employed, reveals trends common for both G.O.'s and revenues. There has been a downward trend in underwriting costs and a compression in yield differentials over time. Moreover, the lower the quality, the more robust the trend. The unspecified variable that appears to account for these trends is a persistent difference between the default risk expected by the market and the default risk actually experienced. Consequently, over the period investigated, the market has revised upward its estimates of the quality of tax-exempts. Since a larger fraction of the promised yield of low- relative to high-quality bonds is accounted for by default risk, a similar argument applies to underwriters' spreads; the yields and underwriting costs of low-quality bonds have been most affected.

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