Transactions Costs in the Agency Bond Market

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During the past several years the Federal Agency bond market has grown substantially. On the supply side the size of the typical new issue increased to about $300 million and several agencies developed or further established regular issuing patterns. Concurrently, the demand for agency securities increased as some securities became acceptable in bank portfolios and as investors showed an increased awareness of the market. With the growth of this market and with the development of the market participants there have been several opportunities for change in the determinants of transactions costs.

The primary purpose of this paper is to examine the determinants of transactions costs in the agency market as it expanded. It turns out that the determinants of the transactions costs (bid-ask price spreads) are robust to the continuing market growth and to changes in interest rate structures. Most changes in the relative strength of these determinants may be attributed to changes in the term structure of interest rates and changes in the risk of making markets in these securities associated with changing market conditions and growth of the market.

II. Determinants of Transactions Costs

Previous studies have emphasized common stocks on the New York Stock Exchange and in the over-the-counter markets. These studies support the conclusions that transactions costs vary directly with price levels and inversely with measures of increased activity such as the numbers of shareholders, transactions and dealers and dollar volume.[1]

Studies of bid-ask price spreads for issues in the bond markets support

price levels, coupon rates and issue size and directly with yields and term to maturity.[2] The empirical results obtained in these two markets can be reconciled insofar as decreased term to maturity and increased issue size are surrogates for increased bond market activity.[3] However, the differential impact of price levels on transactions costs in the common stock and bond markets suggests that there are differences in the cost structures in these markets.

In this study of the bond market it is hypothesized that price spreads are a function of price levels and of market activity. Spreads should increase as price levels decrease because the typical bond portfolio is likely to contain many securities with the same term to maturity. In this case, if it is suddenly necessary to sell one of the bonds in the portfolio, and if the bonds are identical except for their price, the bond with the highest price will be sold as it has the lowest yield for its remaining term to maturity or, alternatively, because it is currently overpriced relative to the other bonds. Since the lowest priced bonds are least likely to be sold, the dealer provides more services and accepts more risk when such a bond is sold and therefore demand a larger service fee. It can also be shown that the same price spread for two differently priced bonds implies that the low priced bond has a larger yield spread than does the high priced bond. The relatively large yield spread associated with the low priced bond increases the frictions associated with completing a transaction increasing the market maker's risk. In turn, the market maker demands an extra fee or a larger price spread as a reward for the risk taken.

Spreads should decrease with increased market activity due to decreases in market making risk. If issue size and term to maturity are used as indi-

cators of market activity, then the spreads should decrease with increasing issue sizes and decreasing terms to maturity. With the increased issue size, availability of the security increases and there is an increased likelihood of being able to complete a transaction quickly. Spreads should increase with the term to maturity of the security. Investors in long term securities often use these obligations to hedge their future long term obligations resulting in a low turnover rate for these securities. Also, even if turnover rates for long term securities were the same as for short term securities, the prices of these securities are more sensitive to interest rate fluctuations than are prices of short term securities. Dealers making markets in these securities must face greater interest rate risks and charge a greater fee for their services.

Studies of common stock price spreads indicate that increases in the number of market makers in a security accompany decreases in the spread. This is particularly important when there are relatively few market makers in a security. However, it is likely that this variable will have little or no impact on the margin in the agency markets since the number of market makers is much larger than in the common stock case.

General market conditions also have an impact on market making risks and transactions costs. For example, future rates implicit in the term structure imply expected future price patterns for bonds. These data and measures of dispersion help market makers determine the price change risk they accept with any security. These data are common to all securities in the agency market at any point in time and help determine the relative importance of the size, term to maturity and other security specific variables in explaining the price spread at that time. If similar market conditions

affect all bond markets at any one time, then a price spread measure from the government markets will be helpful in measuring these conditions in the agency markets.

III. The Empirical Analysis

The data include all bonds issued by the agencies and the World Bank and the Interamerican Development Bank (excluding participation certificates). Inclusion of the two banks expanded the sample. The bonds also had to be outstanding for at least two years prior to the date of interest so that only seasoned bonds and only bonds with an initial maturity over two years are in the sample. This sample was chosen as, unlike the government bonds, there was a steady flow of new issues into the market at all points of the maturity spectrum and because the long term government bonds had special redemption features.[4] Although this market is smaller than the government market, issues are more plentiful and the issues represent a relatively homogeneous group.

The analysis presented here is based on bid ask price spreads obtained at the end of February, 1966, February, 1968, February, 1970 and February, 1972. The data were obtained from the Bank and Quotation Record. As such they do not represent negotiated prices from one dealer, but represent typical prices and price spreads available to the trader requiring an immediate sale or purchase of a security. Yields are based on the average of the bid and ask prices and assume continuous compounding. Coupon, issue size and maturity data are from the Federal Reserve Bulletin and from Moody's Manuals.

For part of the analysis a set of index of government price spreads is also used. This set of indexes includes subindexes for each year to maturity from 1 to 5 years and indexes for 5 - 10 years and 10 - 15 years.

Shorter term indexes were not available and longer term indexes were ignored because of the aforementioned special redemption features. Each subindex includes all government securities except the 1½% notes with the appropriate term to maturity and weights each acceptable security equally. These indexes will be used as a measure of general bond market quality. Due to the limited use of this set of indexes analyses including the government bond indexes will be based on a relatively small set of observations.

A. A Survey of the Samples

Table 1 contains comparative summary information for each sample in the study. A survey of these data indicates that the four chosen dates represent a variety of different market conditions. Lines 13 through 20 of the table representing the yield curve suggest a curve that rises, then falls in 1966, curves that rise steadily in 1968 and 1970 and a steeply rising curve in 1972. Also, interest rate levels, as indicated by the 1 month rate were the same in 1966 and 1968, but rose by more than two percent by 1970 and then fell by over three percent by 1972. If lines 21 and 22 are used to measure the interest rate volatility and the uncertainty associated with holding inventories for short periods and measure general market risk that market makers must accept, then the increased range and the significantly increased standard deviation of the month-to-month yield changes would indicate increases in the risk accepted by market makers. The risk in 1968 is significantly greater than that in 1966, but does not change from 1968 to 1970 and from 1970 to 1972. Market making risk in 1970 and 1972 are also significantly different from that in 1966 paralleling a confirmed change in market conditions.[6]

The agency market grew continuously from 1966 to 1972. The dollar volume of funds meeting the qualifications of the study grew 153% during the period or at a 20.5% annual rate.

The average amount of a bond outstanding and in the sample grew from $127 million to $225 million or by 76% (9.9%/yr.). Also, new issues added to the sample between 1970 and 1972 averaged $295 million or more than twice the average issue size of 1966. The term to maturity of the typical security in the sample (line 6) changed by 6% to 8% from date to date, but since it initially increased and then decreased, the net change for the full period was a decrease of 8.2%. During the period the average dollar spread and the average percent spreads (lines 10 and 11) increased and then decreased to approximately its initial size. Difference of the means tests indicate that despite the growth of the agency markets the average spread was significantly greater in 1968 than 1966. Although the change in spreads from 1968 to 1970 was insignificant, the typical spread in 1972 was significantly lower than in 1970. This test also shows that 1966 and 1972 spreads are not significantly different from each other so that, as a first approximation and using price spreads as the basic measure, the agency market worsened and finally returned to its 1966 level despite its great growth.

Finally, during each of the first three periods the average yield was greater than the average coupon and the average price of a bond was less than par. However, the fourth period average yield was less than the average coupon, but the average price was still below par. This can occur as yields and coupons may not be related to maturity structures, but bond premiums or discounts from par are a function of maturity. A survey of the data shows that 32 of the 89 prices were below par, but that low prices predominated at the long end of the market.[7]

In sum, during the sample period the market grew substantially, the

and the relation between the current rate and expected rates changed substantially during the sample. Moreover, the typical price spread showed some changes during the period.

B. Empirical Analysis of Price and Percent Spreads

Changed market conditions suggest that there may have been substantial changes in the determinants of the spreads from period to period. This possibility can be supported further by examining the correlation between price spreads and other available data at each point in time. These data, in Table 2, show that the relationship between some of the potential variables and the price spread has changed during the period. Three price-related variables, coupon, yield and the bid price all show a changing relationship with price spreads. Although coupons and spreads are always negatively related, the relationship is significant at the 5% level in only 2 cases. The yield variable is significant and positive at the 5% level in the last 3 periods, but is insignificant and negative in 1966. Although the bid price is significant and negatively related to the spread in each period, the relationship is considerably weaker in 1972 than in earlier periods. However, the government spread index issue size and term to maturity variables are significant in every period and vary over relatively narrow ranges. Despite the changes in the relationship between price spreads and some of these variables over time, it turns out that the relationships between selected determinants and price spreads remain relatively constant and, when comparing 1966 to 1968, the coefficients of these determinants remain constant statistically.

As an initial test, dollar price spreads and percentage spreads were regressed on a size variable and a term to maturity variable. The data reported hereafter emphasize the natural logs of each bond's issue size and of each bond's term to maturity rather than the actual size and term to maturity of the bond as

these results were generally slightly stronger than those obtained using the raw data. However, in every case the results using raw data would have the same interpretation as that presented here.

The initial test included the following regression equation:

$$S_P = A_0 + A_1 S + A_2 TM$$

where:

S_P = a bid-ask spread variable,

S = a size variable,

TM = a term to maturity variable

and previous analysis suggests that $A_1 < 0$ and $A_2 > 0$.

The estimated coefficients and the correlations between the independent variables are presented in Table 3. The results obtained here are generally encouraging. In all but one of the cases the log of the issue size variable is significant and negative at the 5% level. In the remaining case the variable is significant at the 10% level. The log of the term to maturity variable is significant and positive at the 5% level in every case so that price and percentage spreads increase with term to maturity and decrease with size but at ever decreasing rates. Moreover, the coefficients of each of these variables have the same magnitude and the amount of variance explained is typically almost 70%.

The total structural relationship between spreads and the independent variables does not remain stable across all the dates in the sample. If the 4 samples are pooled and if the results of the pooled test are compared to the four individual periods, the resulting F statistic indicates, at the 5% level, that the structural relationship changed during the 6 year period. When each pair of samples including non-adjacant samples, is compared using the pooled

pairing, there is a unique relationship between size and term to maturity and price spreads each period. However, in the 1968, 1970 case, the entire structural relation (including the constant) doesn't change.

There are two possible reasons for this result. First, the equations may be misspecified due to the absence of additional explanatory variables. Alternatively, the spread relationships may be effected primarily by changes in the term structure of interest rates, changes in market making risk or some other market forces and that the mere growth of this market doesn't necessarily cause changes in structural relationships.

C. The Misspecification Problem

In order to examine the possibility of misspecification in the regression relationship, the analysis was reformulated in several ways. First, the size relationsip was tested further. Second, the impact of the inclusion of World Bank and Interamerican Bank bonds was considered. Third, the government index was added. Fourth, price and coupon measures were tested. Finally, the regressions were rerun in raw and log forms based on the work of Tanner and Kochin.[8]

It has been suggested that there was an optimal issue size in the Agency primary markets during the period in question.[9] An optimal issue size may also be present in the secondary markets. If so, then price spreads should first decrease, then increase as the secondary market improves and then becomes glutted with increases in issue size. Inclusion of a second order size term to test this possibility had virtually no impact when used in conjunction with the raw size data. The variable was never significantly different from zero. When the second order variable was substituted for the raw size variable, the results do not change substantially from when size was used alone. Here the signs are all negative and the variable is significant at the 5% level at 3 of the 4 dates. Even if there is an optimal issue size in the primary

market, it does not exist in the secondary market. In fact, these results suggest that increased issue size may lead to ever greater marginal improvements in market quality.

The World Bank and the Interamerican Bank are not agencies like the Federal Land Bank and the other agencies in the sample. To compensate for this sample hetergeneity a dummy variable was associated with securities issued by these banks. Due to the issuing policies of these banks, the correlations between the dummy variable and the size variable are -.400, -.371, -516 and -.647 and between the dummy and the term to maturity variables are .698, .669, .755 and .712 for 1966, 1968, 1970 and 1972 respectively. Although these correlations suggest that there is heterogeneity between the agency market and these securities, it should be noted that the typical security associated with any one agency does not necessarily reflect the typical security available in the agency markets.

The correlations between the dummy variable and dollar price spreads and dollar price spreads are .435, .738, .889 and .405 for 1966, 1968, 1970 and 1972 respectively. Although these data suggest that price spreads are higher for these securities, the correlation of the dummy variable with the term to maturity variable with the term to maturity variable creates a potential collinearity problem in any analysis comparing the spreads to the size, term to maturity and dummy variables jointly. In a multiple regression the dummy variable is significant and positive at the 5% level in 1968 and 1970, but not significant and negative in 1966 and 1972. Resultingly, there is no clear evidence from the joint regression test that inclusion of these two groups of securities has any systematic and continuing effect on this analysis and no clear evidence here that these securities are treated in a continually and significantly different manner than agency securities.

and term to maturity variables. Selected summary data are in table 4. The average spread for government securities is based on the spread subindexes as weighted by the dispersion of agency securities across these subindexes. In this form the average government spread had the identical pattern as the agency spreads. It rose from 1966 to 1970 and fell by 1972. Concurrent with changes in government policy in 1965, the standard deviation of the spreads rose significantly after 1966. However, the index does not have a strong and consistent relationship with the agency spreads when included in a multiple regression analysis. The index had a negative and significant relationship with the agency spreads in 1966. The relationship was insignificant and positive in 1968 and 1970 and insignificant and negative in 1972. The cause of this irregular pattern is the potential collinearity between the index and the term to maturity variable.

The relationship between the agency and government spreads as analyzed by difference of the means tests from lines 7 and 8 of the table show that the agency and government markets were significantly different for the entire period. The jump in the difference from 1966 to 1968 occurred coincident to the change in government policy affecting interest rate volatility. This change caused market making risk to increase more in the agency market than in the more developed government market. Continued rapid expansion of the agency markets after 1968 caused the relative difference in market making risk to decrease through 1972.

To examine the possible misspecification problem further, the price level of each bond was added to logs of the size and term to maturity variables. The results in Table 5 show that the size and term to maturity variables retain their signs and are generally significantly different from zero at the 5% level. However, each variable is significant only at the 10% level in one of

The price variable is not as consistent as the other variables. Although it is significantly different from zero is one form or another during every period and is significant in 6 of 8 cases, one result has the 'wrong' sign and the coefficients vary by more than a power of 10 from -0.086 in 1968 to -0.003 in 1972. Additionally, depending on the equation, the decreases in the previously unexplained variances range from virtually nil to over 50%. Part of the problem lies in the correlation between the term to maturity and price variables. Despite statistically insignificant multicollinearity a survey of the results indicates that either the term to maturity variable or the price variable, but not both, has a T-value over 7 for each date in at least 1 of the 2 forms of the regression.[10] The price variable is highly significant in 1968 and 1970 when the correlation between the term to maturity and price variables is relatively strong (-0.742 and -0.758). However, when the correlation weakens somewhat (-0.604 and -0.519 in 1966 and 1972 respectively), the term to maturity variable is stronger.

Tests of the observed structural relationships yield the same results as obtained in the earlier case. This supports the hypothesis that any change or lack of change in the relationship between spreads and independent variables is more likely to be due to comparative term structures of interest rates rather than to a misspecification problem. However, the continued collinearity between the term to maturity and price or other variables may yet shield the true relationship.

Due to the interaction between the term to maturity and price variables, the bond's coupon was substituted for the price variable.[11] The coupon is a reasonable substitution for price levels here as it is less likely to be dependent on maturity considerations and because all other things equal, equilibrium bond prices will have the same ranking as the coupons. Empirically, the

correlations between coupons and prices are 0.695, 0.405, 0.590 and 0.731 for 1966, 1968, 1970 and 1972 respectively.

Use of the coupon as an independent variable reduces the collinearity problems associated with the term to maturity variable substantially. The correlations between the term to maturity and the coupon variables are low at -0.006, 0.091, -0.108 and -0.267 respectively. However, from Table 6 the coefficients of determination fall from those in Table 5 so that the net improvements from Table 3 range from marginal to 29%.[12] The results obtained for coupon variable echo those obtained for price levels in that structural stability remains in the same pattern as before and in that coupons appear more important in 1968 and 1970 than in 1966 and 1972 and that low coupons (prices) are related to large spreads. However, in the 1968 and 1970 cases, where collinearity had heretofore been most severe the coefficients of the term to maturity variable return to the levels observed in Table 3.

Any collinearity problems that were associated with the size variables throughout the analysis remain. The correlation between a bond's coupon and log of the issue size is about the same on average as that between its price and the log of the issue size. However, in the 1966 sample this correlation fell from 0.461 to 0.306 and in 1972 it fell from 0.652 to 0.619. The correlation rose from 0.476 to 0.604 and from 0.546 to 0.639 in the 1968 and 1970 cases respectively. Despite these period by period changes in correlation the coefficients of the size variable did not change substantially when coupons replaced prices. Insofar as there may be collinearity between the coupon and size variables the coefficient of the size variable may be understated in Tables 5 and 6 relative to Table 3. However, any such biases will be less in this case due to the disappearance of the collinearity problems associated with the term to maturity variable. Resultingly, coupons and the prices they represent

appear related to price and percentage spreads and transactions costs in the 1968 and 1970 markets, but not in 1966 and 1972.

As a final test the analysis was redone in the same form used by Tanner and Kochen.[13] Dollar price spreads were regressed on the size, term to maturity, coupon and yield variables. This process was repeated with all the variables in log form. Despite the additional independent variable the coefficients of determination changed only slightly. Since their sample of Canadian government bonds was drawn in October 1969, most attention was paid to this study's February, 1968 and February, 1970 samples. In absolute form the R^2's were .75 and .77 for these dates. In log form they were .81 and .73. These represent little change from the results listed in table 6 and ignoring the yield variable. The correlations between the independent variables also indicate that there are greater collinearity problems using my data and this model than obtained using the earlier models. With the increased collinearity problems it turns out that the 1968 and 1970 periods are no longer structurally identical.

Conclusions

Spreads in the agency bond market are not identical in structure to those in the common stock markets. Agency spreads appear associated with market structure as it is summarized by the term to maturity and size variables. Also, the results are likely to be sensitive to price levels and coupon levels in a manner inverse to that observed in the common stock market. There is also evidence that the agency market has developed as it has grown so that market making risk relative to other markets has decreased. Any systematic increases in the agency price spreads over the period can be traced to changes

affecting the market making risks in the entire bond market.

Despite the insignificance of the difference of the means test comparing the average price spreads in 1966 and 1972, it is clear that the agency markets changed substantially during the period. The structural relationships are significantly different and the average spread in 1972, although appearing identical to that in 1966, represents substantial development of the agency market in the face of decreased interest rate control exercised by the government and greater market making risk.

Finally, the structural relationships observed in 1968 are the same as that observed in 1970 statistically despite changes in some aspects of the market. Since this relationship is robust to changes in independent variables and is unlikely to be due to a misspecification error it is likely that a prime force in determining the cost of transactions is expected interest rates in the form of the term structure of interest rates. In such an environment spreads can be a function of market variables such as term to maturity and size, but the coefficients of these variables may be determined by the relative levels of current and future interest rates.

TABLE 1

Sample Summary Data

	Feb 66		Feb 68		Feb 70		Feb 72	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
1. Sample	62		64		76		89	
2. New Securities this Period			18		31		38	
3. Coupon (1%)	4.27	0.50	4.59°	0.77	5.68°	1.56	6.47°	1.67
4. Yield (%)	5.12	0.16	5.88°	0.38	7.86°	0.40	5.66°	1.10
5. Issue Size ($ Millions)	127.74	59.70	148.75	100.87	180.05	101.57	224.88°	113.24
6. Term to Maturity (Months)	75.82	67.73	80.59	81.45	75.64	84.92	69.64	81.94
7. 3-4 (%)	0.85	0.51	1.29°	0.83	2.18°	1.61	-0.82°	2.13
8. 3/4 (%)	1.22	0.16	1.32°	0.24	1.49°	0.43	0.95°	0.37
9. Price ($)	95.79	3.79	92.80°	6.72	89.47°	11.10	98.02°	8.41
10. Spread ($)	0.71	0.37	1.08°	0.65	1.12	0.65	0.77°	0.32
11. 10/9 (%)	0.74	0.40	1.21°	0.81	1.34	0.92	0.80°	0.35
12. Total Funds Represented in Study ($Million)	7920		9520		13684		20014	
13. Yield (1 Mo. Security)(%)*	7920 4.57		4.53		6.87		3.17	
14. Yield (1-2 Yr. Security) (%)*	5.22		5.46		7.74		4.64	
15. Yield (20+ Yr. Security) (%)*	4.97		6.13		8.07		7.21	
16. 15-13 (%)	0.40		1.60		1.20		4.04	
17. 15/13	1.09		1.35		1.17		2.27	
18. 14-13 (%)	0.65		0.93		0.87		1.47	
19. 15-14	-0.25		0.67		0.33		2.57	
20. Correlation (TM,Y)	-0.46		0.52		0.35		0.82	
21. Yield Range(%)*a	1.01		2.07		2.23		1.69	
22. Yield Change (%)*a	0.08	0.35	0.05	0.63°	0.10	0.55	-0.01	0.53

*These data include all agency and similar bonds and includes issues not considered elsewhere in this analysis.

[a]These data are for 1 month agency and similar securities and are based on the 12 months up to and including the month in question. Line 21 = (High Yield - Low Yield). Line 22 is the distribution of month to month yield

Table 2

Correlations Between Potential Determinants of the Price Spread and The Price Spread

	Feb 1966	Feb 1968	Feb 1970	Feb 1972
Government Spread Index*	.383°	.540°	.633°	.325°
Coupon	-.135	-.332°	-.557°	-.192
Size	-.643°	-.477°	-.604°	-.380°
Term to Maturity	.623°	.700°	.682°	.564°
Yield	-.184	.582°	.442°	.631°
Bid Price	-.584°	-.877°	-.850°	-.290°
Log Size	-.610°	-.517°	-.635°	-.367°
Log Term to Maturity	.812°	.745°	.709°	.765°

*The Government Spread Index correlations are based on 47, 48, 53 and 58 observations for 1966, 1968, 1970 and 1972 respectively.

°Significantly different from zero at the 5% level

TABLE 3

Spreads as a Function of Size and Term to Maturity

	February 1966		February 1968		February 1970		February 1972	
	$**	%**	$	%	$	%	$	%
Coefficient	0.93	1.01	1.78	1.99	2.45	2.90	0.30	0.65
(T-Value)	(2.79)	(2.91)	(4.18)	(3.63)	(5.90)	(5.02)	(1.23)	(2.81)
LS*	-0.23	-0.25	-0.40	-0.47	-0.46	-0.60	-0.03	-0.10
(T-Value)	(3.86)	(4.09)	(5.13)	(4.74)	(6.41)	(6.05)	(0.72)	(2.72)
LTM*	0.22	0.24	0.33	0.40	0.27	0.40	0.18	0.20
(T-Value)	(8.79)	(9.14)	(9.11)	(8.60)	(7.99)	(8.67)	(9.72)	(11.32)
R^2	0.73	0.75	0.69	0.66	0.68	0.69	0.59	0.70
$SE_{y.x}$	0.20	0.21	0.37	0.48	0.37	0.51	0.21	0.20
Correlation (LS,LTM)	-0.466°		-0.213		-0.333°		-0.421°	

*LS is the natural log of the issue size and LTM is the natural log of the term to maturity. in months.

**Spreads in dollars and in percent

°Correlation significantly different from zero at the 5% level

Table 4

Selected Summary Data
Government Spread Index**

	Feb 1966	Feb 1968	Feb 1970	Feb 1972
Observations	47	48	53	58
1. Avg. Spread *($)	0.147	0.268	0.387	0.362
2. Standard Deviation	0.049	0.122	0.252	0.182
3. Correlation (TM, GOVT)	0.894	0.894	0.934	0.818
4. Correlation (LTM, GOVT)	0.797	0.852	0.821	0.718
5. Correlation (LS, GOVT)	-0.189	-0.168	-0.418	-0.476
6. Correlation (Bid Price, GOVT)	-0.470	-0.725	-0.811	-0.675
7. Avg.(Diff. between Agency & Gov't Spreads)**	0.611°	0.818°	0.759°	0.479°
8. Standard Deviation **	0.050	0.085	0.090	0.039

*This average is for the spread index as weighted by the number of agency bonds to which it is compared with each term to maturity. Effectively it is the average spread in the government market if that market had the same distribution of terms to maturity as then evidenced in the agency market.

**All data in this table are based on this subset of observations.

° Significantly different from zero at the 5% level.

TABLE 5

Spreads as a Function of Size, Term to Maturity and Price

	February 1966		February 1968		February 1970		February 1972	
	$	%	$	%	$	%	$	%
Coefficient	1.56	2.70	6.86	9.57	4.98	7.57	-0.29	0.84
(T-Value)	(1.76)	(3.03)	(7.76)	(9.37)	(8.87)	(12.01)	(0.88)	(2.58)
LS	-0.21	-0.22	-0.19	-0.16	-0.27	-0.26	-0.09	-0.08
(T-Value)	(3.53)	(3.54)	(2.70)	(2.02)	(4.03)	(3.41)	(2.02)	(1.89)
LTM	0.21	0.21	0.13	0.11	0.10	0.09	0.20	0.20
(T-Value)	(7.22)	(7.13)	(3.08)	(2.20)	(2.37)	(1.94)	(10.22)	(10.57)
Price*	-0.07	-0.18	-0.58	-0.86	-0.32	-0.59	0.09	-0.03
(T-Value)	(0.77)	(2.05)	(6.22)	(8.01)	(5.73)	(9.42)	(9.42)	(0.82)
R^2	0.73	0.76	0.81	0.84	0.78	0.86	0.62	0.71
SE.y.x	0.20	0.20	0.29	0.34	0.31	0.35	0.20	0.19
Correlation (LS, Price)	0.461°		0.476°		0.546°		0.652°	
Correlation (LTM, Price)	-0.604°		-0.742°		-0.758°		-0.519°	
Correlation (LS, LTM)	-0.466°		-0.213		-0.333°		-0.421°	

*Prices are bid prices scaled by division by 10.

°Correlation significantly different from zero at the 5% level.

TABLE 6

Spreads as a Function of Size, Term to Maturity and Coupon

	February 1966		February 1968		February 1970		February 1972	
	$	%	$	%	$	%	$	%
Coefficient	1.00	1.19	1.80	2.04	1.97	2.19	0.33	0.61
(T-Value)	(2.82)	(3.31)	(4.58)	(4.03)	(5.21)	(4.26)	(1.32)	(2.61)
LS	-0.21	-0.21	-0.20	-0.21	-0.21	-0.23	-0.05	-0.07
(T-Value)	(3.40)	(3.34)	(2.16)	(1.74)	(2.53)	(2.06)	(1.00)	(1.58)
LTM	0.22	0.24	0.36	0.44	0.29	0.43	0.18	0.20
(T-Value)	(8.72)	(9.40)	(10.32)	(9.92)	(9.69)	(10.73)	(9.70)	(11.32)
CP	-0.03	-0.09	-0.24	-0.32	-0.15	-0.22	0.01	-0.02
(T-Value)	(0.62)	(1.62)	(3.25)	(3.43)	(4.76)	(5.17)	(0.73)	(1.10)
R^2	0.73	0.76	0.74	0.72	0.76	0.78	0.59	0.70
$SE_{y.x}$	0.20	0.20	0.34	0.44	0.32	0.44	0.21	0.20
Correlation (LS,CP)	0.306°		0.604°		0.639°		0.619°	
Correlation (LTM,CP)	-0.006		0.091		-0.108		-0.267°	
Correlation (LS,LTM)	-0.466°		-0.213		-0.333°		-0.421°	

*CP is the bond's coupon

°Correlation significantly different from zero at the 5% level.

FOOTNOTES

[1]See Harold Demsetz, "The Cost of Transacting," Quarterly Journal of Economics, 82 (Feb. 1968), Richard R. West and Seha M. Tinic, The Economics of the Stock Market (New York: Praeger Publishers, 1971) and Seha M. Tinic and Richard R. West, "Competition and the Pricing of Dealer Service in the Over-The-Counter Stock Market," Journal of Financial and Quantitative Analysis (June 1972).

[2]See John S. Bildersee, Price Spreads, Performance and the Seasoning of New Bond Issues, University of Pennsylvania, (1975) and J. Ernest Tanner and Levis A. Kochin, "The Determinants of the Difference Between Bid and Ask Prices on Government Bonds," Journal of Business (October 1971).

[3]An examination of a daily-average dealer transactions time series suggests that this is the case with respect to the term to maturity variable. See the Federal Reserve Bulletin.

[4]Inclusion of these bonds would make the relationship appear undeservedly strong. This feature discourages trading encouraging a greater price spread and would strengthen the correlation between the term to maturity and spread variables. If a dummy variable approach were used almost all the observations in the long end would have the dummy and relatively few in the short end would have it. The dummy would merely become surrogate for the term to maturity variable.

[5]This compounding convention is for simplicity and using it has virtually no effect on any slope coefficients. It will have a small impact on the intercept term in regression analysis.

[6]See Normand Bernard, "Views of U.S. Government Securities Dealers," Joint Treasury-Federal Reserve Study of the U.S. Government Securities Market, Staff-Studies-Part I Federal Reserve System (1970). This study comments that in the last half of 1975, changes in government investment and interest rate policies began to destroy the then generally accepted belief that the government would only allow interest rates to fluctuate within a relatively narrow range. The previous policy, which would be reflected in the 1966 data, but not in subsequent periods, implied less risk for market makers.

[7]In a 6% market a 2 yr, 8% bond will cost $102.66 and a 10 yr, 5% bond will cost $92.60. The average coupon is 0.5% greater than the yield, but the average price is $1.87 below par.

[8]Tanner and Kochin, op. cit.

[9]See William H. Silber, "The Market for Federal Agency Securities: Is There an Optimal Size of Issue?" Review of Economics and Statistics (February 1975).

[10]The test used here is described in Yoel Haitovsky, "Multicollineanty in Regression Analysis: Comment," The Review of Economics and Statistics LI (November 1969).

[11]Other variables such as the yield/coupon ratio and the difference between the yield and the coupon were also examined. The results in these cases were indistinguishable

[12]There was no obvious pattern associated with any changes that did occur.

[13] Tanner and Kochin, op. cit.