Bond Yield Uncertainty and the Demand for Money: A Comment

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Abstract:
The purpose of this paper is to reconsider the work recently reported by Amihud that the demand for money is an increasing function of the risk of holding bonds. Our evidence from testing annual and quarterly Cambridge *k* and demand-for-money equations cannot confirm the positive and significant bond-yield uncertainty coefficient reported by Amihud in a semi-annual Cambridge *k* equation.

Article:
1. Introduction
Recently, Amihud (1980) argues that Friedman's (1956, 1970) and Tobin's (1958) theoretical work on money as a capital asset provides a justification to include a measure of uncertainty in a money-demand equation. Tobin's analysis of utility maximizing behavior suggested that risk-averse individuals would hold money as a portion of their portfolio because of the uncertainty of future levels of interest rates. Therefore, there is risk associated with an expected return on any interest bearing asset. Amihud (1980, p. 65) includes a risk variable which is 'the mean of squared deviations of actual monthly [bond] yields from their semi-annual averages' in a semi-annual Cambridge *k* function and finds consistent evidence of a positive and significant coefficient. This evidence is cited to support his hypothesis that the demand for money is positively related to the risk of holding bonds.
The purpose of this note is to test for the robustness of Amihud's results by estimating both a Cambridge *k* and a money-demand equation for annual data over the 1952-1974 and 1921-1974 periods and for quarterly data over the 1962-1973 and 1962-1979 periods. There is no evidence of a positive and significant coefficient for the risk variable in either the demand-for-money equation or the Cambridge *k* equation.

2. The model and annual results
Amihud's model is not specified as the usual partial-adjustment model for demand-for-money function, but rather as a partial-adjustment model of the Cambridge *k* function where the dependent variable is (M/Py). The equation is

$$\ln(M/Py) = a + b_1 \ln y_t + b_2 \ln r_t + b_3 \ln S_t + b_4 \ln(M/Py)_{t-1} + u_t, \quad (1)$$

where M is the quantity of money, P is the GNP deflator in 1972 prices, y is real national income (GNP), and r is an opportunity cost variable which is either the yield on four-six month prime commercial paper (r_S) or the yield on long-term AAA corporate bonds (r_L) and u_t is the residual.[1] The measure of risk (S_t) is defined as the mean of the squared deviations of the actual monthly yields from their annual average. The expected signs of the coefficients are $b_2 < 0$, $b_3 > 0$ and $0 < b_4 < 1$. According to Amihud (1980, p. 65), the sign of the real income coefficient, b_1 'should hover around zero being slightly positive for M_2 and negative for M_1'. His coefficient estimates, however, are biased and inconsistent because real income is both a right-hand side variable and is divided into real money balances to form the dependent variable.[2] Therefore, a money demand equation is also tested to obtain consistent estimates:

$$\ln m_t = \alpha + \beta_1 \ln y_t + \beta_2 \ln r_t + \beta_3 \ln S_t + \beta_4 \ln m_{t-1} + \varepsilon_t, \quad (2)$$

where m is real per-capita money balances, y is per-capita real income and ε_t is another residual term. The expected signs are $\beta_1, \beta_3 > 0$; $\beta_2 < 0$ and $0 < \beta_4 < 1$.

Table 1
Annual results.[a]

Cambridge k (1952–1974)		c	y	r_s	r_L	S	$(M/Py)_{t-1}$	$\overline{R^2}$	SE	$D.W.$	Durbin-h[b]	ρ
M_1	(1.1)	2.66	−0.52	−0.027		0.001	0.31	0.980	0.0110	1.99	0.15	0.86
		(6.09)	(6.63)	(2.54)		(0.62)	(3.58)					(8.67)
–	(1.2)	1.08	−0.22		0.021	−0.001	0.76	0.992	0.0176	1.66	1.12	–
		(1.85)	(1.92)		(0.46)	(0.51)	(5.31)					
M_2	(1.3)	−0.62	0.06	−0.066		0.001	0.65	0.869	0.0173	1.68	0.95	–
		(2.85)	(1.51)	(3.48)		(0.60)	(5.00)					
–	(1.4)	−0.14	−0.02		−0.013	−0.002	0.67	0.785	0.0221	2.14	−0.55	–
		(0.34)	(0.26)		(0.24)	(0.46)	(4.09)					
Money demand (1952–1974)							(m_{t-1})					
M_1	(1.5)	−0.19	0.16	−0.041		−0.004	0.95	0.946	0.0144	1.85	0.39	–
		(2.92)	(3.38)	(2.62)		(2.08)	(14.28)					
–	(1.6)	−0.18	0.17		−0.064	−0.006	0.93	0.953	0.0135	1.56	1.12	–
		(3.14)	(2.91)		(1.99)	(2.52)	(13.79)					
M_2	(1.7)	−0.44	0.51	−0.074		−0.003	0.68	0.992	0.0111	1.71	0.74	–
		(8.91)	(7.89)	(6.13)		(1.60)	(9.51)					
–	(1.8)	−0.39	0.47		−0.082	−0.005	0.69	0.983	0.0159	1.88	0.32	–
		(5.14)	(4.33)		(2.35)	(1.79)	(7.12)					
(1921–1974)												
M_1	(1.9)	−0.27	0.27	−0.065		−0.005	0.67	0.955	0.0309	1.83	0.66	0.60
		(5.21)	(5.59)	(4.59)		(4.90)	(13.62)					(5.07)
–	(1.10)	−0.06	0.40		−0.281	0.002	0.50	0.906	0.0381	1.77	1.01	0.68
		(0.71)	(5.97)		(5.06)	(0.49)	(6.84)					(6.58)
M_2	(1.11)	−0.21	0.35	−0.030		−0.004	0.59	0.971	0.0281	1.68	1.25	0.47
		(6.26)	(7.58)	(2.96)		(3.88)	(11.95)					(3.63)
–	(1.12)	−0.10	0.41		−0.011	0.001	0.51	0.922	0.0356	1.77	0.97	0.60
		(1.58)	(6.70)		(2.80)	(0.35)	(7.63)					(5.38)

[a] T-scores are in parentheses. The results were run on the 3.5c version of TSP.
[b] The Durbin-h statistic is given, though its small sample properties have not been established.

Results are presented in table 1 for the Cambridge *k* and money-demand equations for the 1952-1974 period which represents Amihud's identical time-period except that our results employ annual data whereas his equation is based upon semi-annual data. The coefficient on the risk variable is consistently insignificant regardless of the definition of money and the interest rate for the Cambridge *k* equation.[3] The results of estimating the money demand equation reveal risk coefficients which are negative and significant for a two-tailed test at the five percent level of significance in only one of the four equations. This annual evidence refutes Amihud's hypothesis that an increase in the risk of holding bonds will increase the demand for money for the 1952-1974 period.

Eqs. (1) and (2) were also estimated with annual data for the 1921-1974 period. The Cambridge *k* results are not reported because the risk coefficients are insignificant. The money demand results, reported in table 1, reveal negative and significant risk coefficients in the short-term interest rate equation for M_1 and M_2 [see equations (1.9) and (1.11)] but insignificant risk coefficients in the long-term interest rate equations [see equations (1.10) and (1.12)].[4] These results provide additional confirmation that the risk coefficient is not a positive and significant variable in a money demand equation.

3. Quarterly results

The availability of weekly interest rate data for both three-month treasury bills (r_S') and twenty-year Treasury bonds (r_L') beginning in 1962 provides an opportunity to test a quarterly money demand equation for the 1962/1-1973/IV period. The risk variable (S_t') is the log of the mean of the squared deviations of weekly yields from the quarterly average yield. The results of estimating the equation for the short-term interest rate are reported as eq. (3):

$$m_t = \underset{(2.18)}{-0.91} + \underset{(3.55)}{0.19}\, y_t + \underset{(2.41)}{-0.08}\, rtd_t + \underset{(2.41)}{-0.01}\, r_s' + \underset{(0.71)}{0.001}\, S_t' + \underset{(4.49)}{0.61}\, m_{t-1}, \qquad (3)$$

$$\overline{R^2} = 0.9998,\ SE = 0.0446,\ D.W. = 1.49,\ \text{Durbin-}h = 5.51,\ \rho = 0.50,$$

where m is the log of real M_{1B} balances, *y* is the log of real income and *rtd* is the log of the rate-on-time deposits. The results reveal an insignificant coefficient for the risk variable, though the Durbin-h statistic reveals the presence of autocorrelation.[5] Similar results occur when r_L' is substituted for r_S'.[6]

4. Conclusion

The purpose of this paper has been to test the robustness of Amihud's results which showed that a variable to measure the risk of holding bonds is positive and significant in a Cambridge *k* equation. A positive and significant coefficient for the risk variable is not confirmed in this study in either a Cambridge *k* equation or a demand-for-money equation with annual data for the 1952-1974 and 1921-1974 time periods or with quarterly data for the 1962/I-1973/IV time period.

Notes:

[1] Amihud employs short-term and long-term yields on government securities which we shall use in our quarterly data.

[2] The correlation between *y* and (M_1/Py) and (M_2/Py) *is -0.99* and - 0.80 respectively for the annual data from 1952-1974.

[3] Amihud defines *S* to be the average of S_t plus S_{t-1} based either on observations of r_s and r_L. The money demand results reported in table 1 are not substantially changed if *S* is defined in this manner. We did not test Amihud's measure of risk based upon the mean of squared deviations of the difference between actual and predicted monthly interest rates.

[4] If the years of 1940-1947 are omitted from the data, then the risk coefficient is only negative and significant in the short-term interest rate M_1 and M_2 equations.

[5] Similar results are obtained if the rate-on-time deposit coefficient is constrained to zero.
[6] The risk variable is also insignificant in M_1 and M_2 money-demand equations for the 1962/I-1979/IV period and for a Cambridge *k* equation for 1962/I-1973/IV.

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