by Yakov Amihud and Haim Mendelson

Liquidity and Stock Returns

If investors value securities according to their returns net of trading costs, then they should require a higher expected return, the higher a stock's bid-ask spread, in order to compensate them for the higher cost of trading. Thus the higher a stock's spread, the higher its observed return should be. The exact relation between spread and return is complicated, however, by the effects of investors' holding periods.

A longer holding period reduces the amortized transaction cost per unit of time. Hence low-spread stocks will tend to be held in equilibrium by short-term investors. The effect of the percentage spread on observed stock returns should thus be positive, but should be moderated as the spread increases.

The evidence culled from NYSE stock returns over the 1961–80 period indicates that spread has a highly significant positive effect on stock return. Furthermore, the monthly excess return of a stock with a 1.5 per cent spread is 0.45 per cent greater than that of a stock with a 0.5 per cent spread, but the monthly excess return of a stock with a 5 per cent spread is only 0.09 per cent greater than that of a stock with a 4 per cent spread. The returns on high-spread stocks are higher, but less spread-sensitive, than the returns on low-spread stocks.

ADVERTISEMENTS FOR various investments, mutual funds and the like stress liquidity considerations no less than risk aspects. Investment consultants and portfolio managers earn their living by tailoring portfolios to accommodate their clients' time horizons and liquidity preferences. But despite their evident importance, liquidity considerations have not received anything like the attention paid to risk in the finance literature.[1] The classical Capital Asset Pricing Model pays no attention to the effects of asset liquidity and investor holding periods on expected returns.

Does liquidity have a measurable effect on stock returns? This article examines the role of liquidity considerations in the pricing of capital assets, focusing on the relation between stock returns and their bid-ask spreads. It discusses the joint effect of security bid-ask spreads and investor planning horizons (i.e., the length of time the investor plans to hold the security) on expected return and tests the hypothesis that expected return is an increasing and concave function of the bid-ask spread. The empirical evidence demonstrates that the spread is an important determinant of stock return.

The Bid-Ask Spread and Stock Returns

The bid-ask spread is the difference between the bid and ask (offer) prices quoted by a dealer who makes a market in a stock and bridges the time gaps between asynchronous public buy and sell orders. The ask (offer) price quoted for a security includes a premium for immediate buying, and the bid price reflects a price concession for immediate sale. The bid-ask spread may thus be viewed as the price the dealer (or market-maker) demands for providing liquidity services and immediacy of execution.[2]

1. Footnotes appear at end of article.

Yakov Amihud is a member of the Faculty of Management of Tel Aviv University and of the Graduate School of Business of New York University. Haim Mendelson is Associate Professor at the Graduate School of Management of the University of Rochester.

Studies show that the bid-ask spread, as a percentage of the stock price, exhibits a strong negative correlation with stock attributes that reflect liquidity—trading volume, number of shareholders, number of dealers making a market in the stock, and degree of price continuity.[3] Thus the spread—the sum of the buying premium and the selling concession—is a natural measure of the cost of illiquidity.

How does the bid-ask spread affect stock returns? If investors value securities according to their returns net of trading costs, then they should require a higher expected return for higher spread stocks in order to compensate them for the higher cost of trading. Investment decisions should thus depend, not only on the risk inherent in a security, but also on its liquidity. Furthermore, it is important to note that, while an investor can reduce security risk by holding a diversified portfolio or by hedging in the capital markets, there is little he can do on his own to avoid the cost of illiquidity.[4]

Holding Period Effects

If investors' holding periods were equal across all stocks, then the total required return for each stock would be the required net return plus the percentage bid-ask spread (amortized over the holding period). If all stocks were held for one year, for example, a stock with a 2 per cent spread would be expected to yield 1.5 per cent more than a stock with a 0.5 per cent spread. But variations in investors' holding periods, as well as uncertainty about their liquidation needs, complicate the return-spread relation.

The cost associated with the bid-ask spread has to be borne only once over a holding period: The premium is paid when the stock is purchased, and the price concession is made at its sale. A longer holding period thus reduces the amortized transaction cost per unit of time (as shown in the appendix). A related consideration is the probability of the investor's having to sell the stock before the end of his holding period. The lower this probability, the lower the required compensation for liquidation costs included in the stock return.

Thus the longer the period over which the stock is held, or the lower the probability of liquidation within a given period, the lower the added return required to compensate the investor for an increase in the bid-ask spread. Gross required return should thus increase as the bid-ask spread increases, but the increment should decrease as holding period increases or probability of liquidation decreases.

Investors with different holding periods will thus require different gross rates of return from the same security. Although everybody presumably prefers securities with lower percentage spreads, investors with shorter holding periods will be willing to pay more to acquire the low-spread securities than investors with longer holding periods, because the latter can amortize the spread cost over a longer period.

This means that the equilibrium allocation of stocks across investors will depend on the interplay between stock spread and planning horizon. In equilibrium, short-term investors should hold the low-spread securities, while long-term investors buy the high-spread securities. Similarly, because investors will prefer to liquidate low-spread securities before high-spread securities, probability of liquidation should decrease as spread increases.[5]

Price Effects

The observed relation between security returns and percentage bid-ask spreads should reflect the equilibrium allocation of securities across investors and investors' liquidation strategies. Observed gross returns should increase with the spread. For example, if two assets generating the same (gross) cash flow have the same observed return, but the spread of one security exceeds the spread for the other, then investors should bid up the price of the lower-spread stock. Its observed return should decline. The higher the spread, the higher the observed return should be.

Now, to examine the effects of planning horizon (or liquidation probability), consider the increase in observed gross returns induced by a 0.1 per cent increase in spread. Because low-spread stocks are held in equilibrium by short-term investors (and because their liquidation probability is higher), the added return required to compensate investors for the increased spread will be higher for these stocks than for the higher-spread stocks. The marginal increase in return to compensate for a 0.1 per cent increase in spread should decrease as spread increases (although the total return will still increase).

The relation may be expressed by the following formula:

$$R = r + f(s),$$

where R is the observed gross return on a stock with percentage spread s; r is the required net return (which depends on the stock's systematic risk); and f(s) is an increasing and concave function.[6] The effect of the percentage spread s on the observed stock return R is positive, but the effect is moderated as the spread increases.

The Evidence

We hypothesize that expected stock returns increase at decreasing rates as the bid-ask spread increases. We should thus observe that average stock returns describe an increasing and concave function of spread.

To test the hypothesis, we examined New York Stock Exchange stocks having the requisite bid-ask spread data over the 1961–80 period. Bid-ask prices were calculated using data for the last trading day of the year; the spread used for each year is the average of the beginning and end-of-year relative spreads.[7]

We first ranked securities by their bid-ask spread in each year T and divided them into seven equal portfolios.[8] We estimated the systematic risk (the beta coefficient) for each portfolio by regressing the portfolio's monthly excess returns on the market excess return over the 60-month period ending at year T.[9] We thus had, for each year, seven stock portfolios characterized by average bid-ask spread and beta risk.

To estimate the effects of the spread and beta values on stock returns, we calculated each portfolio's average monthly excess return in the following year, T + 1. These average monthly returns were decomposed into a beta effect, a spread effect, a year effect and a residual term.[10] The relation between expected stock returns, beta and spread across stock portfolios was estimated by regressing $R_{j,T+1}$, the portfolio's average monthly excess returns in the year T + 1, on its systematic risk, B_{jT}, spread, S_{jT}, and a year-effect variable.[11] For notational convenience, we shall henceforth omit all year subscripts.

Tests of Beta and Spread

We first tested the Capital Asset Pricing Model, which posits a positive relation between expected stock return and beta risk. We obtained the following estimates:

$$R_j = -0.0030 + 0.0172\beta_j + u_j, \qquad (1)$$
$$(4.99)$$

Table I Correlations

Correlations Between:	
average return and (the logarithm of) spread	= 0.242
average return and beta	= 0.105
beta and (the logarithm of) spread	= 0.780

where

R_j = the portfolio's average monthly excess return,

β_j = the portfolio's beta coefficient, and

u_j = a variable that includes both the estimated year-effect variables and unexplained residuals.[12]

The t-value for the estimated beta coefficient is shown in parentheses. The results of Equation (1) lend support to the conventional CAPM: There is a significant positive relation between return and beta.

We next added a spread variable to test for a spread effect. According to our hypothesis, the excess returns should be an increasing and concave function of the bid-ask spread. We thus included the spread in logarithmic form and obtained the following estimates:

$$R_j = 0.273 + 0.0023\beta_j$$
$$(0.40)$$
$$+ 0.00375 \log S_j + u_j. \qquad (2)$$
$$(3.23)$$

The spread variable emerges as highly significant, whereas the beta variable appears considerably weakened. Another view of the relation between return, spread and beta is provided by the estimated correlation coefficients between these variables, shown in Table I.

Finally, we estimated the regression model using the spread variable only, and obtained the following result:

$$R_j = 0.031 + 0.00412 \log S_j + u_j. \qquad (3)$$
$$(6.16)$$

This indicates a very strong and significant positive relation between return and spread.

Similar results were obtained when we split the sample into two equal subperiods of 10 years each. For the 1961–70 subperiod, the resulting estimates were as follows:

$$R_j = 0.015 + 0.00387 \log S_j + u_j.$$
$$(4.27)$$

For the 1971–80 subperiod, we obtained the following result:

$$R_j = 0.032 + 0.00433 \log S_j + u_j.$$
$$(4.34)$$

In both subperiods, the spread variable had a positive and significant effect. We can conclude that higher-spread stocks have higher excess returns.

By our estimate of Equation (3), the monthly excess return of a stock with a 1.5 per cent spread is 0.45 per cent greater than that of a stock with a 0.5 per cent spread. But the monthly excess return of a stock with a 5 per cent spread is only 0.09 per cent greater than that of a stock with a 4 per cent spread. The returns on higher-spread stocks are higher but less spread-sensitive than the returns on lower-spread stocks.

Implications

Our results have a number of implications for investing and portfolio management. First, low-liquidity investments are expected to produce higher returns for their holders. Coins, real estate and stamps, for example, have yielded unusually high returns.[13] Art and privately placed security issues may also fall within this category.[14] The stocks of small firms suffer from market "thinness," which impairs their liquidity. Our analysis suggests that such stocks should earn higher returns. In fact, the evidence does indicate unusually high returns on small-firm stocks.[15]

Second, our results suggest that portfolio managers should be responsive to their clients' planning horizons. A longer holding period mitigates the burden of illiquidity and increases the net expected return from illiquid assets. Thus, while real estate may be inappropriate for short-term portfolios because of its low liquidity, it may be suitable when held for "strategic" reasons as a permanent component of an investment portfolio—for example, when held by pension funds.[16] Similarly, stamps, which have after-commission returns too low for short-term holding, may provide superior performance over longer periods (four years or more).[17] The same applies to low-liquidity securities. A frequent trader should be directed to low-spread (high-liquidity) securities, but an investor with a long planning horizon may find better opportunities in assets with higher spreads yielding higher expected returns.

Our analysis suggests the existence of liquidity "clienteles" for different assets, analogous to the well known tax and dividend clienteles.[18] Just as it may be advisable for a tax-exempt fund to shift into high-dividend stocks, a fund with a long investment horizon (such as a pension fund) may find it profitable to specialize in relatively illiquid securities, which provide higher returns to long-term investors.

The results also point out the benefits of liquidity-increasing investment vehicles such as no-load mutual funds, which may specialize in low-liquidity stocks as well as other illiquid assets. Because buyers and sellers of the fund's shares act to offset each other, the fund bears only a fraction of the illiquidity costs associated with the underlying assets. The mortgage market accomplishes this by transforming illiquid individual mortgages into tradable mortgage instruments. Money market funds similarly transform short-term debt instruments into assets that are almost as liquid as cash. Mutual funds thus not only provide diversification of risk and professional management, but also serve as important liquidity-increasing vehicles.

Our analysis highlights the importance of devising trading mechanisms that increase liquidity. A security that generates $1 a month in perpetuity, has a 2 per cent bid-ask spread and a required return (given both risk and liquidity characteristics) of 1.5 per cent per month has a value of $66.7 ($= 1/0.015$). If the spread on this security could be reduced to 1 per cent, its value would increase to $82.5. Improvements in trading mechanisms, such as further automation of the trading process, could generate substantial economic benefits.[19] ∎

Appendix

This appendix demonstrates the effect of an investor's holding period on the relation between required return and spread.[20] Consider an investor who buys a stock at time 0 and plans to sell it at time T for an expected price of P_T. Let the price at time 0 be P_0; the investor's actual buying price is $P_{b,0} = P_0(1 + s)$, where s is the percentage spread (this assumes, without loss of generality, that the spread is incurred at the purchase transaction).[21]

The net holding-period return to this investor is equal to $P_T/[P_0(1 + s)] - 1$. Denoting the

(continuously compounded) required net return on the security per unit of time by r, the investor will invest in the stock only if the following condition holds:

$$\frac{P_T}{P_0 (1 + s)} \geq e^{rT}.$$

His minimal *gross* continuously compounded return required from the stock is given by the following:

$$R(s,T) = r + (1/T) \log (1 + s).$$

The above equation states that the compensation required by an investor with holding period T for the percentage spread s is an increasing function of the spread and a decreasing function of the holding period. It follows that longer holding periods mitigate the burden represented by the cost of illiquidity, s.

Footnotes

1. Interestingly, it is the less rigorous, more practitioner-oriented books on securities analysis and portfolio management that discuss "marketability" and "liquidity," as well as investors' planning horizons. Some notable exceptions are an unpublished paper by J. Treynor ("Liquidity, Interest Rates and Inflation," 1979), which notes that "it may not be too rash to suppose that illiquidity premiums are an important element explaining both the differences in the way different stocks are priced at a point in time, and differences in the way the same stock is priced at different points in time," and J. C. Van Horne (*Function and Analysis of Capital Markets* (Englewood Cliffs, N.J.: Prentice Hall, Inc., 1970)), who discusses the liquidity premium for bonds (reflecting both risk and marketability) and suggests that "the lower the marketability of a financial instrument, the greater the yield necessary to attract investors" (p. 119).

   See also T. F. Loeb, "Trading Cost: The Critical Link Between Investment Information and Results," *Financial Analysts Journal*, May/June 1983, pp. 39–44; Loeb studied the illiquidity of common stocks by calculating the round-trip trading costs of large and small firms. Also J. Treynor, "Implementation of Strategy: Execution," in J.L. Maginn and D. Tuttle, eds., *Managing Investment Portfolios: A Dynamic Process* (Boston: Warren, Gorham and Lamont, 1983), pp. 537–572, which studies the effects of trading costs on investment results and elaborates on the determinants of the spread.

   L. Fisher, "Determinants of Risk Premiums on Corporate Bonds," *Journal of Political Economy*, June 1959, pp. 217–237, finds an inverse and significant relation between bonds' yield differences and the market value of the bond issues, used as a proxy for marketability.

2. See, for example, K. Garbade, *Securities Markets* (New York: McGraw Hill, 1982), Chapter 24.

3. Ibid.

4. To see this, note that an investor can eliminate nonsystematic risk associated with any given stock to practically zero by diversification and can form a zero-beta portfolio to avoid the systematic (market-related) risk. However, the investor cannot avoid the costs of illiquidity, which are always additive.

5. See Treynor, "Liquidity, Interest Rates and Inflation," *op. cit.*

6. Throughout the analysis, r represents the return required for a given level of systematic risk. We hold risk constant and focus on the spread effect.

7. The data were furnished by Hans Stoll and Robert Whaley, and are discussed in detail in H. R. Stoll and R. E. Whaley, "Transaction Costs and the Small Firm Effect," *Journal of Financial Economics* 12 (1983), pp. 57–79. The relative stock spread is the actual spread quoted on Fitch's *Stock Quotations on the New York Stock Exchange*, divided by the average of the bid and ask prices. We thus used a direct and explicit measure of the actual bid-ask spread. In the absence of such data, it is possible to resort to Roll's implicit measure (see R. Roll, "A Simple Implicit Measure of the Effective Bid-Ask Spread in an Efficient Market," *Journal of Finance* 39 (1983), pp. 1127–1139). The values of the sample spread range from an average of 0.486 per cent for the first (smallest spread) group to an average of 3.208 per cent for the highest spread group. The number of stocks per year that satisfied the data requirements varied from 636 to 900.

8. We apply the methodology of Fama and MacBeth (see E.F. Fama and J. MacBeth, "Risk, Return and Equilibrium: Empirical Tests," *Journal of Political Economy*, May/June 1973, pp. 607–636), which is now common in testing for factors affecting stock returns. By this method, the estimation is performed over stock portfolios, rather than on individual securities, to reduce the problems resulting from errors in estimation.

9. The systematic risk of each portfolio, β_{jT}, was estimated from the following market model regression:

$$R_{jTk} = \alpha_{jT} + \beta_{jT} R_{mTk} + e_{jTk},$$

where R_{jTk} is the average excess return of the stocks included in portfolio jT in month k, and

R_{mTk} is the excess return on the equally weighted market index in month k. The data source was the University of Chicago CRSP tape. The excess return is the difference between the stock or market return and the 90-day Treasury bill rate.

10. This estimation method is known as pooled cross-section and time-series estimation. For a detailed analysis, see Y. Amihud and H. Mendelson, "Asset Pricing and the Bid-Ask Spread" (MERC Working Paper No. 86-07, University of Rochester, 1986).

11. Our hypothesis relates to the expected (*ex ante*) returns; the estimation follows the common practice of using average *ex post* returns, which are unbiased estimates of the expected returns.

12. The actual estimated equation is of the following form:

$$R_{j,T+1} = a_0 + a_1 \beta_{jT} + \sum_{t=1961}^{1979} d_t D_t + e_{j,T+1},$$

where the year-effect variables D_t are 19 zero-one variables that take on a value of one in year T and zero otherwise. They are inserted to account for differences in average excess returns between years, thus capturing the year effects.

13. See A. Kane, "Coins: Anatomy of a Fad Asset," *Journal of Portfolio Management*, Winter 1984, pp. 44–51; H.R. Fogler, "20% in Real Estate: Can Theory Justify It?" *Journal of Portfolio Management*, Winter 1984, pp. 6–13; R.H. Zerbst and B.R. Cambon, "Real Estate: Historical Returns and Risks," *Journal of Portfolio Management*, Spring

1984, pp. 5–20; and W.M. Taylor, "The Estimation of Quality Adjusted Rates of Return in Stamp Auction," *Journal of Finance* 38 (1983), pp. 1095–1110.

14. During the 1961–77 period, the average yields on privately placed corporate bonds exceeded those on publicly issued corporate bonds of similar quality, duration and tax treatment by about 50 basis points; see B. Zwick, "Yields on Privately Placed Corporate Bonds," *Journal of Finance* 35 (1980), pp. 23–29. This may be considered a compensation for the lower liquidity of privately placed bonds.

15. See G.W. Schwert, "Size and Stock Return, and Other Empirical Regularities," *Journal of Financial Economics* 12 (1983), pp. 3–12.

16. This is pointed out in Fogler, "20% in Real Estate," *op. cit.*

17. See Taylor, "The Estimation of Quality," *op. cit.*

18. There is no need for risk clientele because, regardless of the particular asset's risk, an investor can choose any desired risk level by choosing an appropriate portfolio of securities.

19. See Y. Amihud and H. Mendelson, "An Integrated Computerized Trading System," in Y. Amihud, T. Ho and R. Schwartz, eds., *Market Making and the Changing Structure of the Securities Industry* (New York: Heath-Lexington, 1985).

20. For a rigorous model, see Amihud and Mendelson, "Asset Pricing and the Bid-Ask Spread," *op. cit.*

21. This assumption simply calibrates prices in terms of the bid price.