Liquidity is an important factor in asset pricing. For both stocks and bonds, the lower the liquidity of an asset (that is, the higher the cost of trading it), the higher the return it is expected to yield. This does not necessarily mean that investors are better off holding assets with low liquidity, because higher transaction costs can eat up return gains. Only investors with long holding periods benefit from holding low-liquidity assets.

When designing an investment portfolio, a portfolio manager should consider not only the client's risk aversion, but also its investment horizon. A short horizon calls for investing in liquid assets, whereas a long investment horizon enables the investor to earn higher net returns by investing in illiquid assets. The analyst can quantify this liquidity-return tradeoff in light of the client's investment horizon. Financial analysts should also consider how changes in assets' liquidity will affect asset values.

Given the negative effects of illiquidity on asset prices, liquidity should affect the design of publicly traded securities. The more liquid a financial instrument, the higher the price for which it can be sold. Liquidity considerations should also affect financial policies. Companies whose claims are traded in the capital market can benefit by undertaking steps to increase the liquidity of their claims, thus reducing their cost of capital. Public authorities can help reduce the cost of capital and increase market efficiency by devising rules and procedures that increase the liquidity of traded assets. They should avoid laws and regulations that hurt the liquidity of the capital markets.

Liquidity (or Marketability) is a key attribute of capital assets, and it strongly affects their pricing. The liquidity effect can be likened to the widely known effect of risk on capital assets. Risk-averse investors require higher expected returns to compensate for greater risk. Similarly, investors prefer to commit capital to liquid investments, which can be traded quickly and at low cost whenever the need arises. Investments with less liquidity must offer higher expected returns to attract investors. In equilibrium, the expected returns on capital assets are increasing functions of both risk and illiquidity.

This article presents evidence on the effects of liquidity on asset prices, showing that liquidity is an important determinant of the returns on capital assets. Given the existence of a liquidity effect, we demonstrate its implications for public and private financial policies. We begin with a description of the costs of illiquidity.

Costs of Illiquidity
An asset is liquid if it can be bought or sold at the current market price quickly and at low cost. Illiquidity is thus related to the costs of executing a transaction in the capital markets. In addition to direct transaction costs, which are relatively easy to measure, the costs of illiquidity include the difference between the actual execution price and the price that would have prevailed in the absence of the transaction, which is virtually impossible to measure. Illiquidity costs can be separated into a number of distinct components.

(1) Bid-ask spread: Dealers and market-makers

1. Footnotes appear at end of article.
quote bid and ask prices, and public traders enter orders with limit prices at which they are willing to buy or sell securities.2 The best price quoted on the sell side (the ask price) is always higher than the best price quoted on the buy side (the bid price), and the difference between the two is the security’s “inside” bid-ask spread; it represents a cost to investors. Asset liquidity is inversely related to the bid-ask spread. I.B.M., for example, typically has a spread equal to about 0.13 per cent of the stock price, while the spread on Treasury bills is about 0.008 per cent of their price. Illiquid stocks and bonds may have bid-ask spreads equal to 5 to 10 per cent of their value.

(2) Market-impact costs are incurred when an investor trading a large quantity drives the market price up when buying or down when selling beyond the best bid and ask prices. The larger the order, the greater the price concession the seller usually makes to effect a sale, and the greater the price premium the buyer has to pay for an immediate purchase. Market-impact costs can be interpreted as the effective bid-ask spread for large orders, which is revealed through actual transaction prices. It is estimated, for example, that the market-impact costs incurred to buy a given portfolio of small-cap stocks will be double or triple the costs implied by the quoted bid-ask spread.3

(3) Delay and search costs are incurred when a trader delays the execution of a transaction in an attempt to accomplish better trading terms—e.g., better prices than those quoted, or reduced market-impact cost. These costs include the actual cost of contacting potential trading partners and the risk borne by the investor while searching and delaying the execution. The trader thus faces a tradeoff between (a) transacting immediately and bearing the bid-ask spread and market impact costs or (b) opting for a better price and bearing the associated delay and search costs.4 Organized securities markets and the use of advanced systems that display the best prices can considerably lower these costs.

(4) Direct transaction costs include brokerage commissions, exchange fees and transaction taxes. On stocks listed on the New York Stock Exchange (NYSE), the brokerage commissions for institutional investors are about 6.5 cents per share or 13 cents for a round-trip transaction, which amounts to 0.325 per cent of a $40 stock.5 For Treasury bills, commissions are between 0.00125 and 0.0025 per cent of value, with somewhat higher figures for individual investors. Exchange fees vary across exchanges and constitute a very small part of the total cost of transacting. Transaction taxes exist in a number of countries and are on the order of 0.1 to 0.5 per cent of transaction value. A 0.5 per cent securities transaction excise tax has recently been proposed for securities transactions on U.S. capital markets.6

These components of transaction costs are highly correlated. We examine their impact on asset prices below.

Illiquidity and Asset Prices
The costs of illiquidity, while constituting a small fraction of asset prices, have relatively large effects on their values. For example, the median bid-ask spread quoted on the NYSE is $0.25, which constitutes 0.625 per cent of the price of an average $40 stock. Adding the brokerage costs (both on buying and on selling) brings the cost of a round-trip transaction to about 1 per cent of the stock price. A 1 per cent transaction cost affects stock prices by more than 1 per cent, because it is incurred repeatedly through the life of the stock. It is the present value of illiquidity costs that constitutes the effect of illiquidity on asset prices.

The large effect of apparently small transac-
tion costs can be illustrated with the following simple example. Consider a perpetuity bond with a coupon payment equal to the return required by investors and a market value of $100. Now assume that the bond is traded once a year at a cost of $1 per trade, incurred (for simplicity) at the purchase. Discounting at a real rate of return of 4 per cent gives the present value of the infinite stream of transaction costs (including the cost of the first transaction):

$$\sum_{t=0}^{\infty} \frac{1}{1.04^t} = 1 + 1/1.04 + 1/1.04^2 + 1/1.04^3 + \ldots = \$26.$$  

Thus transaction costs of just $1 translate into present value costs of $26.

The burden of transaction costs is lower when the bond is traded less frequently, say once in two years. The discount factor is then $1/(1.04)^2$, and the present value of the cost stream is $\$13.25$. This approach can be extended straightforwardly to assets with any pattern of cash flows, including the standard dividend growth model of stock prices.

We developed an equilibrium model that shows how asset prices depend on their liquidity when rational investors consider the transaction costs amortized over their investment horizons. In our model, assets are characterized by their transaction costs and investors are characterized by their holding periods. Assets generate a given dividend stream, and investors have limited capital. In equilibrium, investors price assets so as to maximize the expected value of the cash flow stream the assets generate, accounting for the negative cash flows due to transaction costs.

The main result of our model is that, in equilibrium, the lower the liquidity of an asset, the lower its price. Put differently, asset returns increase with illiquidity, thus compensating investors for bearing illiquidity costs. Furthermore, the effects of illiquidity costs are stronger, the more liquid the asset. Because transaction costs are incurred more frequently for liquid assets, their present values are higher (and their returns lower) than those of less liquid assets.

Investors in assets with infinite lifetimes will incur transaction costs at some point, because they will ultimately convert the assets into cash (e.g., in order to consume). Bonds have finite maturities; investors can thus obtain their cash value at maturity and save the costs of transacting. But the positive relation between asset yields and illiquidity should also hold for bonds, because investors face uncertain future liquidity needs.

Bond investors thus face a tradeoff. On one hand, a bond with a short maturity is more likely to mature before the need for liquidation (and the associated transaction costs) arises, but the investor will then incur the costs of reinvestment. On the other hand, a bond with a long maturity is more likely to be liquidated before its maturity, and the investor will then have to pay the costs of liquidation. Investors holding finite-maturity bonds should thus expect to incur transaction costs, and bond prices should reflect differences in bond liquidity. The lower the liquidity (the higher the transaction costs), the lower the price and the higher the yield to maturity should be.

Below we present evidence that supports our hypothesis on the effects of liquidity on capital asset returns.

**Empirical Evidence**

Short-term U.S. government bonds are among the most liquid financial instruments. The bid-ask spread on short-term government notes is about one-quarter the bid-ask spread on highly liquid I.B.M. shares, and the spread on short-term Treasury bills is about one-quarter that on notes. According to our hypothesis, liquidity differences between otherwise identical bonds should translate into yield differences.

We studied the differences in liquidity and yields between U.S. Treasury bills and notes with maturities under six months. At these maturities, both assets are effectively discount bonds, and with matched maturities they represent equivalent cash flows. Their liquidity, however, differs. Bills have lower transaction costs—including both bid-ask spread and brokerage fees—than notes; bills are thus more liquid. The average bid-ask spread on notes in our sample was 0.0303 per cent of their price, whereas the average bid-ask spread on bills was 0.00775 per cent. The brokerage fees, paid by the party initiating the transaction, are $12.5 to $25 per $1,000,000 for bills and $78.125 per $1,000,000 for notes. The total transaction cost for notes is 0.0381 per cent, whereas the transaction cost for bills is approximately 0.009 per cent—about one-quarter the cost for notes.

Our hypothesis predicts that, because notes
are less liquid than bills, they should have higher yields. To test this hypothesis, we used data from quote-sheets; these were “pulled off the screen” and represent real quotes at which actual transactions could have been executed at the time they were recorded. (The data were kindly provided by First Boston, a major dealer in U.S. government securities.) The sample included 37 randomly selected days between April and November of 1987. To control for the maturity effect, we matched each note with two bills whose maturities were closest to that of the note and straddled it. We ended up with 489 “triplets” of matched notes and bills with the same duration.

We calculated the (annualized) yield to maturity on the notes and the bills, \( Y \), by solving

\[
P + AC = \frac{\frac{1}{2}C + 100}{(1 + Y)^{t/T_0}}.
\]

Here \( P \) is the instrument’s ask price, \( AC \) the accumulated interest, \( C \) the annual coupon and \( T \) the maturity in days. (For bills, \( AC = C = 0 \).) The yield on note \( i \) on day \( s \) is denoted by \( Y_{N_i s} \) (\( s = 1, 2, \ldots, 37 \)), and the weighted average of the yields on the two bills whose maturities straddle that of note “\( i \)” is denoted by \( Y_{B_i s} \). The note-bill yield differential is \( \Delta Y_{i s} = Y_{N_i s} - Y_{B_i s} \).

The average yield differential between notes and bills was 0.43 per cent per annum, with a standard error of 0.021 per cent, highly significant. This strongly supports our hypothesis: The lower the liquidity of a bond, the higher its yield.

For notes and bills of short maturity, small price differentials translate into large annual yield differentials. Because fixed transaction costs can be amortized over time, however, the yield differential should be smaller for bonds with longer maturities. This is exactly what we found. The yield differential for longer maturities was about 20 basis points.

The estimated relation between the note-bill yield differential, \( \Delta Y \), and the number of days to maturity, \( T \), was as follows:

\[
\Delta Y_{t_i n} = \gamma_0 + 12.03 \cdot (1/TN_{t_i n}) - 0.014 \cdot C_{t_n} + 9.47 \quad (3.23)
\]

\[
+ \sum_{t=1}^{36} \gamma_t \cdot DD_t + \epsilon_{t_n}. \quad (3)
\]

The \( t \)-values are in parentheses, and DD are dummy variables that control for differences between days. This equation says that the yield difference between notes and bills increases with the reciprocal of the time to maturity; that is, the longer the time to maturity, the smaller the yield difference. (The yield difference is also smaller, the greater the coupon rate on the note.) Increasing the time to maturity from 30 to 150 days reduces the yield difference by 32.1 basis points. (The coefficient of the coupon rate is negative because a higher coupon rate provides greater liquidity for institutions constrained to distribute only earned interest.)

The liquidity theory is also consistent with the finding that “on the run” long-term Treasury bonds, which enjoy high liquidity before being absorbed into investors’ portfolios, have slightly lower yields than “off the run” Treasury bonds. Given the positive illiquidity-yield relation, it would be well that the yield premium on “junk” bonds be attributed to their lower liquidity, in addition to the more obvious risk premium.

In summary, the evidence shows that liquidity differences affect the pricing of bonds: The lower the liquidity, the higher the yield to maturity. These liquidity-induced differences in yields are higher for shorter maturities.

Stock Returns

Stocks have infinite maturities, and the planned holding periods of stock investors vary widely. In equilibrium, long-term investors will end up investing in less liquid assets. Because they can amortize their transaction costs over longer periods, they can outbid short-term investors, for whom the present value of the transaction cost stream on a given stock is higher.

Clearly, long-term investors could outbid short-term investors for any asset, including liquid ones (with low transaction costs). If long-term investors were to buy the liquid assets, however, then, given capital constraints, the illiquid assets would be left for short-term investors. These investors place such a low value on illiquid assets that their prices would decline, making them more attractive to the long-term investors. In equilibrium, assets will be allocated to different investor clienteles: The more liquid assets will be allocated to short-term investors, while the long-term investors will hold the less liquid assets.15
Using the bid-ask spread as a measure of illiquidity, we obtain the following relation between return and liquidity: The expected return on stocks is an increasing and concave function of the bid-ask spread (after controlling for risk). The concavity reflects the clientele effect: Because illiquid assets are less frequently traded, their transaction costs are amortized over longer periods, hence the marginal effect of an increase in transaction costs is smaller.

We studied the empirical relation between bid-ask spreads and risk-adjusted average returns (in excess of 90-day Treasury-bill rates), using 20 years of data (up to 1980) on NYSE stocks. We formed 49 portfolios of stocks grouped by bid-ask spread and by beta coefficient (systematic risk). We then estimated the relation between the bid-ask spread and the portfolios’ average (excess) returns, controlling for beta. The empirical results were consistent with the theoretical predictions: Average returns were an increasing and concave function of the bid-ask spread, after controlling for risk.

Given the concavity of the relation between average returns and the bid-ask spread, we can summarize the illiquidity effect by expressing the expected return as a logarithmic function of the bid-ask spread (and a linear function of beta):

\[
R_i = 0.006477 + 0.01012 \cdot \beta_i + 0.002144 \cdot \log(S_i).
\]

The \( t \)-values are in parentheses. \( R_i \) is the average monthly return on the stocks included in portfolio \( i \) in excess of that month’s 90-day Treasury bill rate. \( S_i \) is the average bid-ask spread (measured as a fraction of the stock price) for the stocks in portfolio \( i \). The logarithmic function represents the concave relation between return and spread in the relevant range. The adjusted \( R^2 \) was 79.24 per cent.

The estimation results in Equation (4) show that expected return is a function of two characteristics—risk and illiquidity. Specifically, return increases linearly in beta, so an increase of one unit of beta is associated with a 1 per cent increase in return. Return also increases with the bid-ask spread, but the relationship is non-linear: Return increases with the spread, at a decreasing rate. By our estimation, a stock whose bid-ask spread is 1.5 per cent would earn an average return that is higher by 0.087 per cent per month than the return earned on a stock with a spread of 1 per cent and the same systematic risk. For an increase in the spread from 0.5 to 1 per cent, the increase in the monthly average return is greater—almost 0.15 per cent—because of the clientele effect.

**Restricted Stocks**

Many publicly traded companies issue restricted (“letter”) stocks, which are not registered with the Securities and Exchange Commission (SEC) for public trading but are otherwise identical with their publicly traded counterparts. Trading of letter stocks on public exchanges is restricted for a certain period—usually 24 months—and the transfer of ownership in them involves some legal requirements. After the restriction period, these stocks can be publicly sold subject to limitations on the pace of sale specified by SEC Rule 144. Comparing the prices of letter stocks to the prices of their liquid, exchange-traded counterparts provides another measure of the effects of illiquidity on asset prices.

The Institutional Investor Study documented the differences between the prices of letter stocks traded in private transactions and the concurrent market prices of the publicly traded versions of the same stocks. The median price discount on restricted stocks was around 25 per cent (in a sample of 398 transactions). Six later studies on restricted stocks, covering the 1968–84 period, showed that the price discounts compensating for the lower liquidity of these stocks was about 35 per cent, and recent court decisions on the appropriate discount on restricted stocks arrive at figures in the 30 per cent area. It follows that less liquidity leads to a substantial discount in asset prices, even if the illiquidity is limited in duration. This evidence is consistent with our hypothesis.

**Changes in Liquidity over Time**

According to our hypothesis, a decline in asset liquidity should bring about a decline in asset prices. This was demonstrated during the stock market crash of October 1987.

Before the crash, conventional wisdom suggested that the market could provide sufficient liquidity when needed, even for large orders. This assumption failed the market test on the
days before the crash, when large orders had an unusual negative impact on prices, and was definitely proved wrong during the crash. At that time, market liquidity deteriorated in a way not hitherto observed. Investors were unable to execute orders or experienced considerable execution delays, the market became “thin,” the price impact of orders was unusually large, and timely information on execution, prices and quotes was largely unavailable. In fact, on October 20 investors faced the prospect of ultimate illiquidity—the closing of the market.

By this view, the crash was a two-step process: First, there was a large price decline, revealing that the market was not as liquid as previously assumed. Next came the crash itself, which reflected a downward revision of investors’ expectations regarding the liquidity of the market.

The decline in liquidity was evident in the considerable increases in bid-ask spreads. We studied a sample of 451 stocks included in the S&P 500 and traded on the NYSE. The average bid-ask spread on these stocks was 27.1 cents (0.788 per cent) before the crash (in the week of October 5–9) and increased to 44.2 cents (1.715 per cent) on the day of the crash. By the end of October, the spreads were still unusually high, averaging 37.6 cents (1.405 per cent). A similar pattern was observed in the International Stock Exchange in London.

This deterioration in market liquidity was not uniform across stocks. According to our hypothesis, stocks that experienced larger declines in liquidity should have suffered larger price declines. We tested this hypothesis by estimating the following model:

\[
\Delta P_i = \alpha_0 + \alpha_1 \cdot \Delta S_i.
\]  

Here \(\Delta P_i\) is the percentage price change of stock \(i\) from October 9, 1987 to October 19 in excess of the expected change conditional on the market. \(\Delta S_i\) is the percentage change in the dollar spread between the week of October 5–9, 1987 and the day of the crash.

According to our hypothesis, \(\alpha_1\) should be negative; that is, the greater the increase in the bid-ask spread, the greater the decline in price should be. The results support this hypothesis. We obtained an \(\alpha_1\) estimate of \(-0.06\) \((t = 7.18)\) significantly negative. This means that a stock whose (dollar) bid-ask spread increased by 100 per cent (above the average increase in spreads) experienced a price decline of 6 per cent over and above its expected market-related decline. That is, the larger the decline in liquidity, the larger the corresponding price decline.

The effect of liquidity on stock prices was evident again after the crash, when liquidity improved and bid-ask spreads narrowed somewhat. Price increases should be largest for stocks whose bid-ask spreads narrowed the most. We reestimated Equation (5) using changes in prices and bid-ask spreads between October 19, 1987 and October 30, 1987 (by which time bid-ask spreads had not reverted to their precrash levels). The results again support the existence of a liquidity effect; we obtained an \(\alpha_1\) estimate of \(-0.08\) \((t = 2.62)\), significantly negative.

Additional estimates showed that, following the crash, there was a “flight to liquidity.” Stocks whose precrash spreads were narrower than average enjoyed greater price appreciation. This reflects a reallocation of investors’ assets in response to the liquidity problems encountered during the crash and greater appreciation of liquidity. These results support our theory of the effect of changes in liquidity on stock prices.

Another piece of evidence on the effect of changes in liquidity on stock price comes from the Tel Aviv Stock Exchange. There, a selected group of stocks was moved from the traditional, once-a-day, batch call trading method to a different method allowing for a number of trading rounds, hence greater liquidity. The stocks that switched to the more liquid trading system enjoyed a significant price increase.

**Implications**

The liquidity effect shows the importance of the microstructure of securities markets and the value of policies aimed at increasing the liquidity of individual securities and of the market as a whole. Proper design of trading methods and market integration facilities can increase the liquidity of traded assets and reduce investors’ required returns. The resulting reduction in the cost of capital would favorably affect the capital formation process and produce both private and public benefits.

Increasing the liquidity of traded assets generates private benefits because the issuers can expect to sell more liquid securities at higher prices. Thus liquidity considerations should be part of financial engineering and must be taken into account in the design of financial instruments. The repackaging and marketing of exist-
ing claims in different forms, for example, can enhance or hamper their liquidity, affecting the value of the new securities. If the newly designed instruments are less liquid, investors may demand less of them. In addition, liquidity-related transaction costs affect the cost of hedging, which is usually an important factor in the pricing of newly designed securities.

When valuing assets, financial analysts should take into account not only the asset’s expected return and risk, but also its liquidity. Among the events that induce changes in securities values, analysts should consider events that trigger changes in liquidity. When a financial adviser “tailors” a portfolio for a client, she should consider not only the client’s risk preferences, but also its liquidity needs. The investment portfolio can then be determined using the return–liquidity tradeoff analyzed above, taking into account the client’s planning horizon and risk aversion.\(^\text{26}\)

We discuss below a few examples of private and public financial policies motivated by their effects on the liquidity of traded capital assets.

**Private Liquidity-Enhancing Policies**

Higher liquidity is associated with a lower expected return on assets. Companies thus have an incentive to invest resources in increasing the liquidity of their financial claims in order to reduce their cost of capital. Liquidity-enhancing policies are, however, costly; companies must therefore weigh the costs of increasing liquidity against the benefits.

First and foremost, firms can increase the liquidity of their equity claims by going public. While the transfer of ownership claims on privately held companies is feasible, it is much more costly than the transfer of claims on public companies. Going public is costly, however, because of the direct cash outlays involved, the greater separation between ownership and control and the greater transparency of the company’s business policies. The liquidity gains from going public explain the willingness of many companies to incur these costs. Listing on organized exchanges, despite their more restrictive regulations and higher listing costs, can also be explained by the company’s desire to increase the liquidity of its claims and reduce its cost of capital.

Companies can employ policies to enhance the liquidity of their traded claims. For example, the limited liability on equity claims facilitates trading. Without limited liability, investors would be reluctant to buy companies’ equity claims in the secondary market, and the claims’ liquidity would be lower. Limited liability is costly because it gives stockholders incentives to undertake policies that could hurt the company, but its liquidity benefits seem to dominate.

Companies’ claims usually conform to a standard structure (e.g., bonds or stocks). While any number of complex sharing rules are possible, standard claims trade more easily and are therefore more liquid.

Another way to increase the liquidity of companies’ claims is to reduce the informational advantage of one group of investors (e.g., insiders) over another. Informational asymmetries widen the bid-ask spread and reduce liquidity.\(^\text{27}\)

Informational asymmetries can be reduced through the disclosure of inside information in regular financial reports and occasional announcements. Many companies would engage in such disclosures voluntarily, even if they were not mandatory, lest the liquidity of their claims suffer. Indeed, companies willingly publish forecasts and other information, and voluntarily have their publicly traded bonds rated (while not doing the same for their privately placed bonds). Ratings provide investors with more information on the bond, increasing its liquidity and helping to reduce required yield.

Liquidity considerations can help explain a variety of corporate financial policies. For example, although rights offers are seemingly less costly than underwritten equity offers, they are not the prevalent form of financing.\(^\text{28}\) Kothare showed that bid-ask spreads increase around rights offers, but decrease following public offers.\(^\text{29}\) This liquidity advantage of public offers may explain the prevalence of rights offers in equity financing.

Corporate payout policies can also be explained by liquidity considerations.\(^\text{30}\) Open-market stock repurchases, for example, have a more adverse effect on stocks’ bid-ask spreads than cash dividends. This suggests that cash distributions in the form of dividends have a liquidity-enhancing role. In general, when investigating the consequences of corporate financial policies, management and analysts should consider their effects on liquidity, as well as risk.

Liquidity effects also help explain the role of the underwriter of corporate securities. The underwriter increases the liquidity of a new security in two ways. First, it examines and
discloses information about the issuer, alleviating investors' apprehension of trading the new security and thus reducing the bid-ask spread.\textsuperscript{31} Second, the underwriter often provides market-making services in the first days after the issuance, thus ensuring the security's liquidity during that period.

The benefits of liquidity make it profitable to buy illiquid financial claims and transform them into liquid ones. This is done by asset securitization. The underlying assets are usually personal liabilities (e.g., mortgages, auto loans), which suffer from low liquidity because they can hardly be traded. They are packaged together, and standard claims are issued against them. The new claims can be publicly traded, and their liquidity is much higher than that of the underlying claims. Thus securitization generates value by transforming illiquid claims into more liquid claims.

The appeal of liquid securities offers another perspective on the proliferation of high-yield ("junk") bonds. These bonds often replaced risky debt that had previously been privately placed with financial institutions and was consequently illiquid. The securitization of such debt would have increased its liquidity, enabling the high-yield bonds to be sold at lower yields than the alternative illiquid forms of debt. Because these bonds are less liquid than rated bonds, their yield premium over rated bonds cannot be attributed entirely to their higher risk; at least part of the extra return earned on high-yield bonds, when compared with investment-grade bonds, may be a compensation for their lower liquidity.

Financial engineering can lower value when a liquid claim is transformed into an illiquid one. For example, one investment banking firm created "unbundled stock units" (USUs), splitting a company's stock into three claims—a bond, a dividend-bearing security and a warrant with special features. While the USU appealed to specialized clienteles and had some tax advantages, the individual claims had lower liquidity than the underlying stock. It was more costly to trade the three USU components because the fixed cost associated with each trade was higher, given the limited "depth" of the market in each component and the nonstandard nature of the claims. The reduced liquidity may have contributed to the failure of the USUs. By contrast, when another investment banking firm introduced "bond stripping," it committed to making a market in the bond strips; this enhanced the instruments' liquidity and the financial benefits of the stripping.

**Liquidity and Public Policy**

Liquidity has benefits that accrue to the public at large (in particular, to those who do not invest in increasing liquidity). Because these benefits cannot be fully captured by those who make the investment in increasing liquidity, there may be insufficient motive for these parties alone to provide the socially optimal level of liquidity. Furthermore, economic agents may take self-serving actions that reduce overall market liquidity.\textsuperscript{32} Public policies may thus have to complement private liquidity-enhancing actions.

In fact, one of the key roles of the Securities and Exchange Commission (SEC) is to facilitate and provide incentives to increase market liquidity and to discourage actions that reduce liquidity. Many of the policies implemented by the SEC can be properly understood only if we accept the notion that market liquidity is a valid public policy objective.

The 1975 Amendments to the Securities Exchange Act of 1934 underlined the role of public policy in enhancing the liquidity of the U.S. securities markets.\textsuperscript{33} In these amendments, Congress called for the SEC and the self-regulatory organizations to facilitate the establishment of an efficient, competitive and fair national market system for securities trading. These amendments established five broad objectives for the national market system—

1. economically efficient execution of transactions;
2. fair competition among market participants;
3. widespread availability of transaction and trading information;
4. order execution in the best markets; and
5. the opportunity (when consistent with the efficiency and best-execution objectives stated above) for investors' orders to be executed without dealer participation.

While the implementation of the 1975 amendments has been the subject of much debate, their intent is clearly to create a public-policy mandate for enhancing the liquidity of the U.S. securities markets. Given the components of illiquidity costs, discussed above, the efficient execution of transactions is tantamount to a
reduction of transaction costs. Competition between markets and best execution translate into lower effective bid-ask spreads and market impact costs. The dissemination of quote and transaction information leads to lower search costs. Direct order execution could reduce or eliminate brokerage commissions. Thus the 1975 amendments operationalized the view that there is a strong public policy interest in enhancing the liquidity of U.S. capital markets and called for the SEC to facilitate and champion this process.

Specific initiatives taken by the SEC over the years are consistent with this view. The implementations of the Consolidated Tape and Composite Quotation System, both initiated by the SEC, reflect the objectives of making information widely available and reducing search and delay costs through the use of information technology. Another recent SEC initiative, Rule 144A, was designed to facilitate trading in privately placed securities. Absent an established market for these securities, it is significantly costlier to trade them than to trade publicly placed issues. Because there is no central system displaying bids and offers for private placements, search costs are higher and so are brokerage fees. The intent of Rule 144A is to increase the liquidity of privately placed securities and thus reduce the cost of capital to their issuers.

The SEC’s efforts to foster competition between market centers, first in the equity markets and then in the options markets, also reflect the objective of increasing market liquidity. The SEC’s recent initiative allowing the multiple listing and trading of stock options, for example, was prompted by the finding that options traded on more than one market have lower bid-ask spreads than comparable options that are traded on only one market. The expectation that allowing the multiple listing and competitive trading of stock options will increase their liquidity led the SEC to require the options exchanges to phase out the “allocation system,” which allocated each new equity option (on listed stocks) to a single market and prevented competition.

Increasing competition between market centers raises the problem of market fragmentation and creates a need for market integration facilities to enhance liquidity. The implementation of the Intermarket Trading System (ITS) in the equity markets and the SEC’s ongoing efforts to create market integration facilities for the options markets reflect its concern for enhancing market liquidity. Similar efforts to integrate national exchanges are being undertaken in Europe.

Transaction Taxes

Public policy initiatives on securities transaction taxes led to the reduction or elimination of such taxes in some countries (e.g., Germany, Ireland, the Netherlands, Japan and Sweden). Recent proposals in the U.S., however, call for a securities transaction excise tax (STET). Our liquidity theory can be used to analyze the effect of transaction taxes. It shows that the decline in liquidity caused by transaction taxes should increase required returns on the taxed securities.

Securities transaction taxes make capital markets less liquid by increasing the cost of trading. There is clearly an immediate increase in cost due to the tax being paid. In addition, because the tax makes the provision of liquidity more costly, it reduces the supply of market-making services (immediacy and liquidity). The resulting decline in trading volume reduces market depth and increases the price impact of large orders, and the decline in available quotes increases search costs and brokerage fees. The effect of the tax on the total cost of liquidity may be greater than that implied by the tax rate, given its detrimental effect on market liquidity.

The effect of securities transaction taxes on stock returns is, according to our model, a function of the stock’s liquidity: The higher the liquidity, the greater the effect of a given tax rate, given the clientele effect. Because liquid stocks have greater market value, and because these stocks are more sensitive to declines in liquidity, the tax is likely to have a preponderant impact on large, liquid stocks.

We calculated the effect of the proposed STET on the expected returns for a large sample of NYSE stocks (using 1980 data), assuming that the tax would not increase any other illiquidity cost component. We found that a 0.5 per cent tax would increase the value-weighted average annual return on NYSE stocks (adjusted for beta) by 1.3 per cent. This represents a considerable increase in the cost of capital. The effect on stock prices depends on the stocks’ required returns and growth rates; for a set of representative values, the expected decline in the value-weighted price on NYSE stocks was 13.8
per cent. An apparently small 0.5 per cent tax can have a sizable effect on stock values and returns.39

Footnotes
4. See Arnott and Wagner (“The Measurement and Control of Trading Costs,” op. cit.) for a discussion of this tradeoff between fast and slow investment ideas and Bodurtha and Quinn (“Does Patient Program Trading Really Pay?” op. cit.) for an actual account of a patient acquisition strategy for illiquid stocks, in which investors incurred higher search and delay costs in order to reduce cost components (1) and (2).
6. See the discussion under “Transaction Taxes” below.
9. This is analogous to the standard assumptions of asset pricing models under risk, where assets are characterized by their risk and investors are characterized by their risk aversion. In our model, investors’ holding periods are random.
11. The conventional bond yield for notes and equivalent bond yields for bills are calculated as \((365 \cdot D)/(360 - T \cdot D)\), using the ask discount. They constitute linear approximations for the actual yield to maturity. This method of yield calculation is biased. Our results were not affected by the method used to calculate \(Y\).
12. The weights are inversely proportional to the number of days between the maturities of the bills and the note.
13. The differential was lower during the period before the October 1987 market crash and increased after it. It declined recently, probably because of the proliferation of systems that reduce the liquidity disadvantages of notes.
14. Here the t-value of 3.23 means that there is one chance in 833 that the estimated effect is, in fact, zero. The higher the t-value, the greater the significance of the results.
The estimation used a geometric-least-squares procedure to correct for heteroscedasticity, where the residual variance was a function of maturity, the sample day and coupon rate. The details are given in Amihud and Mendelson, “liquidity, Maturity and the Yields,” op. cit. The data include maturities of 15 to 182 days.
17. The portfolio betas were estimated over 60 months prior to each year for which the cross-sectional return–spread relation was tested, using the equally weighted market index. The sample size for each year was between 619 and 900 stocks.
18. We also controlled for the portfolios’ unsystematic risk (see Amihud and Mendelson, “The Effects of Beta,” op. cit.). It was insignificant.
19. In general, \(\log(x)\) is a concave function of \(x\)—that is, a function that increases with \(x\), but at a decreasing rate. The clientele effect implies that the expected return should be a concave function of the bid-ask spread.
22. The unusual price declines on October 14–16, 1987 were said to have been caused by antitakeover provisions proposed and approved by the U.S. House Ways and Means Committee.


31. Although not all inside information is disclosed in the prospectus, the underwriter provides a credible “certification” on the quality of the company (and the information in the prospectus). Thus the underwriter reduces the asymmetry of information between insiders and public investors and narrows the bid-ask spread.


33. Public Law No. 94-29, 89 Stat. 97.


37. See Amihud and Mendelson, “How (not) to Integrate,” *op. cit.*


39. In particular, we assumed no increase in brokerage fees following the STET, which makes the 0.5 per cent tax rate equivalent to a 0.356 per cent increase in the bid-ask spread.

Partial financial support for this study was provided by the Business School Trust Faculty Fellowship at Stanford University.