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Author(s): Peter L. Bernstein

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Peter L. Bernstein

Peter L. Bernstein is President of Peter L. Bernstein, Inc., and Editor of The Journal of Portfolio Management.

■ One of the great features of that legal creature we call the corporation is how readily it facilitates transferring ownership in a business. Perhaps the most impressive consequence of that feature has been the development of organized stock markets, in which people can transfer their ownership in corporations without any direct negotiation or contact with the buyer or seller on the other side of the transaction.

These markets can serve their purpose only if they are liquid. The purpose of this paper, therefore, is to explore the concept of liquidity in the market for common stocks and to evaluate different measurements of liquidity that give practical meaning to this concept. Popular terms like "depth, breadth, and resiliency" or "fair and orderly" sound like desirable features for a market, but we seldom ask why they are desirable or how we can determine the degree to which they exist in one market or another.

We shall find that liquidity is not always appropriate and that orderly is not necessarily an end in itself. There is a tension between liquidity — a market in which we can buy and sell promptly with minimal impact on the price of a stock — and efficiency — a market in which prices move rapidly to reflect all new information as it flows into the marketplace. Although these are both essential attributes of a good market, they are not necessarily compatible with each other.

These are not simply academic considerations. On the contrary, the character of the market for stocks is critically important to corporate management. No modern corporation of any size can function effectively without ready access to capital markets at the lowest possible cost.

Indeed, more than a source of finance is involved. The information content in market valuations is a primary component of merger and acquisition decisions, as well as the most popular guide to the appraisal of management's abilities in handling the company's affairs (or vulnerability to takeover); in many instances, market value is a partial but important determinant of management compensation. For these purposes, and in fairness to all concerned, accurate pricing of fundamental values is absolutely essential.

But liquid and efficient markets require a large number of interested and active investors. The larger the number of interested investors, however, the smaller

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the share of the corporation that each investor will own. An investor who owns too small a share to influence management policies in the corporation will be willing to buy those shares only if an exit exists, where the investor can sell the shares whenever a sale serves the investor's needs, whatever they may be. This requirement brings the argument full circle, for only the market can provide the outsider with an exit at a fair price.

In an important sense, therefore, any corporation whose shares are held by outsiders — investors with insufficient shares to control management directly — has an obligation to provide liquid and efficient markets for those outside investors. Paradoxical as it may seem, the easier the exit from ownership of a corporation, the more attractive its ownership becomes.

This means that the cost of capital is a direct function of the character of the market in which the common shares trade. This is a fact of fundamental importance. The relationship between liquidity and the cost of capital.

> *. . . is by no means an anomaly or an indication of market inefficiency; rather, it reflects a rational response by investors in an efficient market when faced with trading friction and transactions costs. The higher yields required on higher-spread [less liquid] stocks give firms an incentive to increase the liquidity of their securities, thus reducing their opportunity cost of capital.* (Amihud and Mendelson [1], p. 2)

The literature on this subject is rich but it is surprisingly limited in size. Although the leading investment textbooks all devote significant space to the concept of market efficiency and the random walk character of stock prices, only two of the books that I surveyed — Reilly [11] and Garbade [5] — devote any space at all to the relationship between market structure and market efficiency, and even that is largely descriptive rather than analytical.

The journal literature is also limited but is also more penetrating and exhaustive than the summary treatment in the textbooks. In addition to the studies cited in detail below, the philosophical underpinnings of this article derive in part from Amihud and Mendelson [1] and Schreiber and Schwartz [12], both of which contain extensive reference lists. Perhaps the most profound work of all in this area is Fischer Black's [2] 1985 presidential address to the American Finance Association; it carries the apt title of "Noise."

The analysis begins by seeking to define the desirable attributes of a stock market and by describing how the stock market purports to provide liquidity. Then these concepts are applied to appraising the character of the market for a stock and the character of the different markets in which stocks trade.

I. "Depth, Breadth, and Resiliency"

These three attributes — "depth, breadth, and resiliency" — are generally accepted as the basic requirements for good markets. Depth and breadth mean that sufficient interest exists on both the sell side and the buy side for traders to be able to execute a large number of transactions in a short period of time. Resiliency means that there is a large "countervailing order flow whenever transaction prices change because of temporary order imbalances" (Garbade [5], p. 428).

This sounds good, but how does a market for stocks establish and maintain these attributes? The answer to this question has something to do with what motivates the buyers and sellers to come into the market in the first place.

Black distinguishes between people who trade on the basis of information and "noise trading [which] is trading on noise as if it were information. . . . Perhaps [noise traders] think the noise they are trading on is information. Or perhaps they just like to trade." ([2], p. 531.)

Noise traders are essential for information traders to have someone to sell to or buy from. Information traders are reluctant to trade with one another, because, as Black puts it, "a trader with a special piece of information will know that other traders have their own special pieces of information and will therefore not automatically rush out to trade." ([2], p. 531.) Then it is the noise traders who provide the depth, breadth, and resiliency.

In other words, the noise traders perform an enormously important economic function, because they make it possible for transactions to occur. *Without transactions, we cannot observe prices,* and prices are the key piece of information in the whole puzzle of investment decisions and company valuations. Quotes are never a substitute for the real thing.

At the same time, however, noise traders, by definition acting on imperfect information, will frequently push prices away from equilibrium values. The resulting undervaluation or overvaluation attracts information traders, who proceed to push prices back to equilibrium values. According to French and Roll ([4], p. 20) in a detailed study of daily return variance, "a

significant fraction of the daily variance is caused by pricing and bid/ask errors [price moving randomly back and forth between bid and ask]. . . . [These] errors have relatively little effect on three- and six-month holding period returns."[1]

The whole process leads to a curious paradox:

> *Noise trading actually puts noise into prices. . . . Prices will be less efficient. What's needed for a liquid market causes prices to be less efficient.* ([2], p. 532.)

Depth, breadth, and resiliency, in other words, are not ends in themselves, but a means to induce information traders to trade. Efficient prices are possible only with noise traders creating inefficiencies by their buying and selling.

How then do these features relate to the other popular attributes of good markets — fair and orderly?

II. "Fair and Orderly"

What is a fair and orderly market and why is it desirable? Consider orderly first. An orderly market is one in which prices change smoothly rather than discontinuously. Depth and breadth should tend to keep prices orderly.

What is so great about that? The main attraction of orderliness, as defined here at least, is that participants in an orderly market can rely on its prices as representing some kind of an equilibrium level. In a disorderly market, with prices jumping all over the place and moving a wide distance from one transaction to the next, we can never figure out precisely what the item in question is really worth. We need noise so that transactions can occur, but we want the noise to be subdued rather than raucous.

What happens if the fundamental value or equilibrium level changes, however? In an orderly market, that change may take a long time to appear, as the price meanders rather than leaps to its new equilibrium. In that case, an orderly market is *inefficient*, in that its price information is giving false signals to potential buyers and sellers. Here is where we would want the noise traders to shut up and where market resiliency is a disadvantage rather than an attraction. In other words, orderly is not always a desirable property of a market.[2]

If orderly is not always a desirable property of a market, what about fair? A fair market is one that helps to assure equilibrium prices by creating conditions in which everyone has an equal opportunity to trade, both in terms of time and in terms of available information. The SEC and the stock market authorities do a good job in making sure that material information is promptly available to potential buyers and sellers of stock, but what about the question of time? Achievement of a stable equilibrium price depends on giving everyone who wants to trade an opportunity to do so.

When the authorities at the New York Stock Exchange and the American Stock Exchange stop trading in a stock, this opportunity is precisely what they aim to create. Before letting the stock price respond immediately to a large imbalance in supply and demand, the authorities stop trading so as to see whether, given time and the advertisement of imbalance provided by the trading halt, other buyers and sellers might come into the marketplace. If the sellers predominate, perhaps additional buyers would be attracted by a potential bargain, thereby limiting the potential price decline. If the buyers predominate, perhaps additional sellers would be attracted by the uptrend in demand, thereby limiting the potential price increase.

The limits to price movements in the commodity exchanges serve the same purpose. They freeze the price until the next day's trading, so that all potential buyers and sellers will know that an imbalance exists and will have an opportunity to come in and take advantage of it, should they wish to do so.

Over-the-counter trading does not provide any such feature to inhibit disorderly price movements.

As with depth, breadth, and resiliency, "fair and orderly" are not ends in themselves. Rather, the goal is price efficiency, or accurate reflections of equilibrium values.

Note that the achievement of market efficiency depends on fairness, not orderliness. All potential buyers and sellers must have a full and equal opportunity to participate in the auction, but, at the same time, the price should change promptly when the equilibrium value changes. Meanwhile, until new information suggests that a higher or lower equilibrium value is appropriate, an orderly market is the best means to assure that current prices accurately represent the equilibrium value; trading stops and price limits are a means of

[1]Fischer Black suggests that reversals from pricing errors caused by noise traders may take a long time to occur. In a personal communication, he observes that "the time required to correct these changes is often measured in months or years."

[2]Although my admiration for Fischer Black's analysis of noise is obvious in the discussion up to this point, the irony of it is that it was he, nearly 15 years ago, who first brought to my attention this dichotomy between orderliness and efficiency in the market.

Exhibit 1. Liquidity Ratio of Common Stocks Sorted by Aggregate Market Value*

	NYSE			AMEX			OTC		
Decile	Number of Stocks	Average Liquidity Ratio†	Liquidity Ratio Range	Number of Stocks	Average Liquidity Ratio†	Liquidity Ratio Range	Number of Stocks	Average Liquidity Ratio†	Liquidity Ratio Range
1	10	7.900	(1–38)	206	3.369	(0–34)	157	7.420	(0–58)
2	44	15.545	(1–65)	154	12.636	(0–60)	163	30.135	(1–417)
3	58	26.069	(2–151)	101	35.148	(2–1099)	115	49.009	(4–328)
4	51	41.510	(12–164)	65	36.508	(5–135)	85	57.671	(4–280)
5	59	57.407	(8–212)	47	46.149	(5–325)	68	120.029	(9–1923)
6	50	58.580	(10–207)	28	54.429	(8–257)	52	116.885	(5–328)
7	103	94.524	(17–275)	51	82.392	(5–290)	63	142.555	(1–589)
8	73	124.685	(27–430)	23	81.435	(14–186)	47	158.191	(29–517)
9	228	223.364	(34–1491)	57	135.948	(0–510)	118	293.873	(16–936)
10	839	1699.181	(34–35579)	69	530.623	(1–5557)	96	668.885	(9–3579)

*From "Liquidity, Exchange Listing, and Common Stock Performance," by S. Kerry Cooper, John C. Groth, and William E. Avera in the *Journal of Economics and Business* (February 1985), p. 27, Table 1.
†Thousands of dollars required to effect a 1% change in market price.

preventing premature disorder.

Thus, orderliness leads to fairness, which leads to efficiency. In the same way, depth, breadth, and resiliency avoid substantial imbalances that necessitate price limits or trading stops and are key indicators that prices are being set in a fair market.

III. How Liquidity Fits

Liquidity and orderliness appear to have a lot in common. They both imply limited price changes.

Money is the liquid asset *par excellence*, whose market has optimal orderliness, because the convention is that we measure prices in terms of money. Consequently, the price of a dollar is always a dollar. We gauge the liquidity of other assets by the extent to which they share this unique characteristic of money — by how closely the price on their last transaction matches the price on the preceding transaction. Furthermore, in a liquid market, price changes should be relatively invariant to the size of the transaction.

Liquidity has another dimension — speed.[3] The prices of houses may be stable in a given time period and in a given location, but those elements do not make a house a liquid asset. The number of potential buyers is limited, legal impedimenta block instantaneous transfers, and transaction costs are high.

The primary function of stock markets is to overcome precisely these kinds of obstacles to liquidity. Stock markets attract large numbers of buyers and sellers, they provide marketmakers to buy and sell when outside buyers and sellers are lacking, they make transfers remarkably simple, and they keep transaction costs low.

Another point requires emphasis. *Liquidity in the sense of limited price changes and speed of execution is possible only so long as an asset's fundamental value or equilibrium price is unchanged.* In liquid markets, the last price is the best indicator of the equilibrium price. New information, however, will raise or lower the equilibrium price, and that change may well be discontinuous. This is where the conflict arises between liquidity and efficiency and between noise traders and information traders.

Here is where we come to the crux of the problem. In assessing the manner in which a stock market or a marketmaker provides liquidity for a given stock, we must somehow distinguish between noise — random swings in supply and demand, whose impact on the stock price the marketmaker should minimize — and more fundamental, information-motivated shifts in supply and demand, whose impact on prices should have free rein.

IV. Pitfalls in Measuring Liquidity

The most intuitive measure of liquidity is to divide the dollar volume of trading by the average absolute percentage change in price. The higher the ratio that results from this calculation, the greater the liquidity of the stock. This is, in fact, the most popular measure of liquidity in use in the marketplace.

A look at some numbers resulting from this technique appears in Exhibit 1, from a study by Cooper, Groth, and Avera [3] covering all stocks listed on the

[3]A quantitative measurement of this feature may be found in Lippman and McCall [9].

Exhibit 2. Average Absolute Value of Percentage Price Change from Previous Trade, by Trade Size and Market*

Trade Size (Shares)	Amex	NASDAQ/ NMS	Combined
Full Sample[a]			
100–500	1.01%	1.45%	1.32%
501–1,000	1.13%	1.41%	1.33%
1,001–9,999	1.39%	1.42%	1.41%
≥ 10,000	1.64%	1.96%	1.71%
All	1.07%	1.45%	1.33%
At Least 1 Trade in Each Group[b]			
100–500	1.02%	1.24%	1.19%
501–1,000	1.09%	1.17%	1.15%
1,001–9,999	1.23%	1.22%	1.22%
≥ 10,000	1.96%	1.64%	1.71%
All	1.07%	1.23%	1.19%
At Least 5 Trades in Each Group[c]			
100–500	0.95%	1.05%	1.03%
501–1,000	0.95%	1.00%	0.98%
1,001–9,999	1.05%	1.04%	1.05%
≥ 10,000	1.34%	1.35%	1.35%
All	0.98%	1.07%	1.06%

[a]764 Amex stocks, 1778 NASDAQ/NMS stocks.
[b]369 Amex stocks, 1249 NASDAQ/NMS stocks.
[c]147 Amex stocks, 837 NASDAQ/NMS stocks.
*From "Exchange Listing and Liquidity: A Comparison of the American Stock Exchange with the NASDAQ National Market System" by Terry Marsh and Kevin Rock, American Stock Exchange Transactions Data Research Project, Report #2, January 1986, p. 8.

New York Stock Exchange and American Stock Exchange, plus 1015 stocks listed on the NASDAQ over-the-counter market, for the period 1978–1981.

Cooper, Groth, and Avera ranked the stocks by the market value of their outstanding common stock (price times number of shares outstanding) and grouped them into deciles of market value. The expectation is that stocks with larger market values should be able to absorb large transactions more readily than stocks with smaller market values.

In order to measure the ability to absorb large transactions, Cooper, Groth, and Avera calculated the following liquidity ratio ([3], p. 25):

$$\frac{\text{Total dollar volume of the stock traded in the last 4 weeks}}{\text{Absolute value of daily \% price change of the stock in the last 4 weeks}}$$

Exhibit 1 does indeed show that this liquidity ratio varies directly with market value. In that sense, it fulfills our expectations.

On the other hand, Exhibit 1 also shows that the distribution of stocks by market value differs across the markets. The New York Stock Exchange has many more large capitalization stocks and many fewer small stocks than the American Stock Exchange or NASDAQ, while the American Stock Exchange has the greatest concentration of small stocks.

Two other aspects of Exhibit 1 are important. First, in all size groups except the very largest and the very smallest, NASDAQ liquidity ratios appear to dominate the New York Stock Exchange ratios. Furthermore, the New York Stock Exchange ratios dominate the American Stock Exchange ratios in all but one size class.

Second, the average liquidity ratio tends to be a poor representative of each size class. The range of ratios within each size class is very wide indeed. In fact, the minimum ratios are absolutely tiny in most cases, which means that illiquidity exists in all size classes. Finally, the maximums generally fail to rise consistently with the rise in market values.

Lack of representativeness is by no means the only shortcoming of this liquidity measure. One obvious difficulty is that much trading over-the-counter is between dealers rather than with ultimate buyers and sellers. As a result, NASDAQ volume may include some double counting and is not directly comparable to volume on the organized exchanges.[4]

A more serious problem with the conventional measure of liquidity appears in a study by Marsh and Rock [10], prepared at the behest of the American Stock Exchange. The Marsh and Rock analysis covers every primary market transaction in every stock on the New York Stock Exchange, the American Stock Exchange, and the NASDAQ/National Market System during March and April 1985 — some 3.3 million transactions in about 4000 different stocks.

As we can see in Exhibit 2, Marsh and Rock compare transactions on the American Stock Exchange and NASDAQ and find that the relationship between price change and trade size is not proportional, except to some degree for transactions of over 10,000 shares. The average percentage price change does not approach zero as trade size shrinks to zero, and average price change does not rise nearly as rapidly as trade

[4]The NASDAQ data in this study have an additional shortcoming that is worth mentioning. At the time of the research performed for [3], the National Market System was not yet in existence. Consequently, the NASDAQ data are based on quoted bids rather than actual transactions. Bids tend to change less frequently than transaction prices, which means that the "price change" data for NASDAQ contain a consistent downward bias.

size. In fact, a regression of price change on market value, institutional share of ownership, daily price volatility, and average trade size produces a coefficient of close to zero on average trade size.[5]

In effect, therefore, the conventional ratio of dollar volume of transactions to change in price will automatically rise as average trade size rises. The numerator of the fraction — dollar volume — will grow faster than the denominator — price change. As large transactions predominate in large stocks on the New York Stock Exchange, small transactions predominate in small stocks on the American Stock Exchange, and larger transactions predominate in medium-sized stocks over-the-counter, the Cooper, Groth, and Avera data may primarily reflect differences in trade size across the three markets. If so, this finding would tell us little about meaningful differences in liquidity.

Marsh and Rock suggest an alternative method to measure the liquidity of a stock. They first calculate the average absolute value of trade-to-trade percentage price change for each stock for a given time period and then divide the result by the total number of transactions in that stock ([10], Equation 6, p. 10). In other words, the Marsh-Rock liquidity ratio relates the change in price to the absolute *number of transactions*, instead of to the dollar volume of trading.

Marsh and Rock defend their concept by hypothesizing that

> *. . . if the typical dealer sets his quotes so as to reflect the underlying equilibrium value of the stock, he should adjust them in accordance with the information content of the orders he receives. Of course, the information content of an order need not be proportional to its dollar amount. . . . If this indeed is true, it implies that the dealer should react primarily to the net* number *of buys versus sells and tolerate a certain imbalance in his portfolio temporarily in the interests of setting the* "right" *price.* ([10], p. 14.)

Marsh and Rock tested their hypothesis on a sample of 25 stocks from the American Stock Exchange and 25 stocks from the NASDAQ/National Market System. They first regressed the average percentage change in the bid and ask for each stock on the dollar volume of buyer-initiated trades less the dollar volume of seller-initiated trades since the previous bid-ask quote change. They then estimated a second regression using the *number* of trades instead of the dollar volumes. Their results demonstrate that the market for these stocks clearly reacts more to the net number of buyers over sellers than to the net dollar volume of purchases over sales.[6]

Finally, Marsh and Rock conclude that liquidity will differ from one market to another, because the organized exchanges by their measures show clearly superior liquidity as compared with the NASDAQ/National Market System. They arrive at this conclusion by regressing price change on market value and average size of trade on 764 American Stock Exchange stocks and then on 1778 NASDAQ stocks, after which they compare the coefficients and intercepts in each case.

The results for each market show that trade-to-trade price changes are larger on NASDAQ after controlling for total market values and for trade size range. The only exception is in trades of 10,000 shares or over, where no advantage is apparent for either marketplace.[7] In addition, a regression of average absolute percentage price change for each exchange on market value, institutional share of ownership, typical daily price volatility, and a dummy variable, with a value of

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[5]The details in [10] appear as Equation (8) on page 12, with t-statistics in parentheses, as follows:

$$\ln \text{AV\%VAR} = 0.198 - 0.299 \ln \text{MV} - 0.005\ \text{\%INST} + 0.259\ \text{DVTY} + 0.101 \ln \text{ATS}$$
$$(-22.76)\quad (-4.66)\quad (19.10)\quad (3.61)$$

where

AV%VAR = average absolute value of trade-to-trade price change,
MV = inter-stock differences in market value,
%INST = institutional % of shares outstanding,
DVTY = longer run daily price volatility, and
ATS = average trade size.

[6]Specifically, the mean slope coefficients, t-statistics, and R^2s for NASDAQ were 0.188, 4.82, and 9.7%, respectively, in the first instance, and 0.454, 6.30, and 15.7% in the second. For the American Stock Exchange, the measurements were 0.410, 7.93, and 6.3%, respectively, in the first instance, and 1.13, 11.02, and 12.6% in the second. See [10], Tables 5 and 6.

In an unpublished manuscript, still incomplete at the time this paper was finished, Marsh and Rock have examined the change in bid and ask relative to the net difference in *share volume* between seller-initiated and buyer-initiated trades, divided by the total share volume of all of these trades. The results suggest that this liquidity measure produces results that are closely similar to their measure of the net difference in *number* of seller-initiated less buyer-initiated trades. They conclude that we cannot reject "the economically sensible hypothesis that it is volume *imbalance* that [matters]."

[7]Although the slopes of the regressions for each exchange differ hardly at all, the intercepts are higher for NASDAQ for each trade size range except the largest, indicating that absolute percentage price change is systematically higher on NASDAQ after controlling for market value and trade size. For trade size ranges of 100–500 shares, 501–1000 shares, and 1001–9999 shares, the NASDAQ intercepts are 24% larger than the Amex intercepts for the smallest size range, 16% larger for the second range, and 7% larger for the third. See [10], Table 7, p. 16.

one for NASDAQ stocks, shows that the dummy variable has strong statistical significance, with a t-statistic of 23.13 ([10], Equation (19), p. 19).

The considerations that suggest this difference in liquidity between markets are important and interesting. We shall defer that part of the discussion, however, while we look at two other liquidity measures based on concepts that differ from those already discussed.

V. Random and Equilibrium Influences

We saw earlier that stock prices will change in response to transitory variations in supply and demand, but that they will also change as a result of more permanent shifts in the equilibrium value of the stock. The character of these two influences produces different kinds of price change.

In the absence of new information, buy and sell orders will come into the market in random fashion, leading prices to swing back and forth without any trend. That is, noise trading will make prices bounce up and down between the bid and ask but will not cause the dealer's quotes to change by much or the quotes will change for only a few trades and then revert to their prior level.

On the other hand, new information should drive the price to a new level. In these instances, big price changes can occur even on small volume and the conventional liquidity ratio of dollar volume of trading to price change will deteriorate in response to information-motivated price movements.

Yet, in actuality, the smaller that conventional liquidity ratio, the more efficiently the market is performing! This is where the distinction between liquidity and efficiency becomes most significant.

In short, a sequence of short-period transactions will cause prices to bounce up and down more frequently than price movements measured over a longer period of time, and those longer-run movements will mostly reflect information-motivated changes in the equilibrium value. This suggests a measure of liquidity based on the ratio of long-term price variability to short-term variability, with a high ratio reflecting better liquidity than a low ratio.

In another study for the American Stock Exchange, Hasbrouck and Schwartz [6] develop this concept and provide measurements of it. Their key measurement is the Market Efficiency Coefficient (MEC), which is, for each stock in their sample, the ratio of long-term variance of logarithmic returns to shorter period returns variance. Their empirical analysis of the MEC covers all trades and quotes for the New York Stock Exchange, the American Stock Exchange, and the NASDAQ/National Market System for 42 trading days in March and April 1985.[8]

Hasbrouck and Schwartz's results show that the ratios of long-term price variations to shorter-term variations for the organized exchanges — the New York Stock Exchange and the American Stock Exchange — are close, with a slight edge in favor of the Amex. The measurements for NASDAQ, on the other hand, are from 15% to 46% below the measurements for the organized exchanges, depending upon the time periods used in the calculations ([6], pp. 9–10, Tables 1 and 2). These differences hold up even after adjustment for differences in market value, although large stocks in all three markets are more liquid than small stocks by these measures.

VI. Inherent Variability

To what extent is the basic riskiness of a stock related to its patterns of price variability and market liquidity? An analysis that Hui and Heubel prepared for the New York Stock Exchange [7] comes at this aspect of the matter from an ingenious viewpoint.

Hui and Heubel begin with the familiar market model of total return on stocks, which hypothesizes that the primary determinant of return on individual stocks is the variation in the stock market itself, recognizing that some stocks tend to be more variable and some less variable than the market as a whole — or to have higher or lower betas, to be precise.

The real world, however, is not exactly the world of theory. Stocks do not perform precisely as the market model predicts. The error in the predictions of the market model reflect variability in the price of a stock that is unrelated to variability in the market. In the parlance of finance theorists, the beta represents systematic risk; the error term represents specific risk.

Hui and Heubel suggest that part of a stock's specific risk will reflect the liquidity of its market. Stocks with high liquidity will tend to perform as the model suggests, because random price fluctuations will be minimal. Stocks with low liquidity will have wider price fluctuations and will therefore tend to deviate further from the market model, with the larger deviation reflected in greater specific risk.

Hui and Heubel do not identify liquidity explicitly with the magnitude of specific risk, nor do they explic-

[8]Hasbrouck and Schwartz measure the MEC on three standards: the ratio of two-day to half-hour returns variance, one-day to one-hour variance, and two-day to one-day variance. The NASDAQ readings for each measure are 0.404, 0.529, and 0.906, respectively, compared to readings of 0.612, 0.689, and 0.958 for the total sample, including stocks on the NYSE and the Amex. See [6], Table 1, p. 9.

itly relate specific risk to size of price change or size of transaction. Although they employ an alternative method whose relevance I would have some difficulty in justifying — they measure liquidity as the sensitivity of specific risk to *changes* in trading volume — their results are interesting nonetheless.

Hui and Heubel's empirical analysis covers trading data for a random sample of 100 companies each from the New York and American Stock Exchanges, the NASDAQ/National Market System, and the remainder of the NASDAQ system, for the three six-month periods running from the first half of 1982 to the end of 1983. They base their results on a regression of the residuals from the market model for each stock on the daily percentage change in dollar volume traded ([7], Equation (3), p. 6).

In this instance, Hui and Heubel find that the New York Stock Exchange provides markets that are more liquid than the markets on the Amex or over-the-counter. From the first half of 1982 through the second half of 1983, their liquidity measurement averaged 0.009 for the New York Stock Exchange, 0.012 for NASDAQ, and 0.203 for the Amex ([7], Table 1, p. 9).

VII. What's Going On Here?

Before the author had read these various studies — and some others not cited here — the author's bias was to expect the over-the-counter market to provide more liquidity than the organized exchanges, if size of stock and other internal company attributes are held equal. The primary reason for this was the expectation that competing marketmakers would provide smaller spreads between bid and ask than a monopolist specialist on the floor. A visit to the London Stock Exchange some years ago, where competing specialists ("jobbers") prevail on the trading floor, had strengthened the author's convictions on this matter. The "Big Bang" on the London market in late 1986 opened the market to dealers everywhere and is based upon the same philosophical concepts.

On the other hand, the organized markets insist that their performance criteria force specialists — even though they are technically monopolists — into acting as though they must compete with other marketmakers in the same stock, quite aside from the contribution to liquidity from the other institutional features that the exchanges provide. But that is not all.

Marsh and Rock offer the most persuasive explanation for the superior showing of the liquidity measures on the organized exchanges ([10], p. 19). The key to the puzzle, they say, is in the direct interaction of public buyers and sellers in the price formation process on the trading floor as compared to the more dominant role of the dealer in the over-the-counter market.

The most significant difference is that individuals or institutions buying and selling exchange-listed stocks can interpose themselves either above the specialist's bid if they want to buy or below the specialist's offer if they want to sell. This ability to interpose public bids and offers tends to narrow the spread and to limit the size of the bounces back and forth that a price is likely to make in response to random variations in demand and supply. Thus, the entire market is competing in setting quotes, which creates a different environment from one in which only dealers can narrow the spreads between bid and ask.

In related fashion, buyers and sellers can in fact trade directly with each other on the floor of the exchanges or, as often happens in jumbo institutional transactions, in "upstairs" trades negotiated by large block houses who frequently help out by taking a position themselves. The NASDAQ/National Market System market provides no institutional arrangement for public traders to negotiate among themselves, although this can and does happen in informal arrangements.[9]

VIII. Liquidity Is Not Obvious

The main conclusion of this analysis is that no single measure tells the whole story about liquidity — and that perhaps liquidity is in the eye of the beholder. One thing is for sure: simple and obvious measurements paint a distorted picture and should receive only minor consideration in any analysis of liquidity. Even internal attributes of the company influence liquidity and should be included before reaching any invidious comparisons with how another company's stock is performing.

In addition, a fair determination of the liquidity of a stock should depend on the analysis of a large number of trades over a long period of time. Fragmentary evidence is positively misleading.

In all fairness, furthermore, measures of liquidity when no information is hitting a stock must be more relevant than measures of liquidity when new information leads to new equilibrium values. Only the Hasbrouck/Schwartz measure discussed here deals explicitly with that distinction.

The most critical factor in the analysis is the recog-

[9]For an eloquent statement of the superiority of markets in the organized exchanges and the manner in which specialists act as though they are in competitive rather than monopolistic situations, see Karmel [8]. Stoll [13] provides further evidence in support of this view.

nition that *price changes are not all alike in origin and significance*. Random variations in prices are noise; prompt price changes in response to new information are essential in markets where prices are the key signal to fundamental values and expectations. A liquid market keeps those random variations tight and minimal, regardless of the size or number of transactions. An efficient market lets prices move fast when perceptions of the company change. This means that unrefined measures of liquidity may be nothing more than some kind of weighted average reflecting the frequency with which new information hits one stock as compared with another.

At this point, the paradoxes abound. Liquidity by itself is likely to lead to less rather than more efficiency. As a consequence, more efficient markets may not attract large numbers of active investors, because price changes will tend to be discontinuous and because knowledgeable investors would not be able to profit from pricing errors. Yet, liquid and efficient markets both need large numbers of active investors.

Indeed, these paradoxes have immediate relevance for the corporate financial officer. If discontinuous price changes make efficient markets unattractive to many investors and, in particular, to knowledgeable investors, the resulting reduction in liquidity means that market efficiency may not always lower the cost of capital for corporations whose shares trade there. On the other hand, the mispricing that can persist in less efficient markets can just as easily be an undervaluation of the company's worth as an overvaluation. Proper handling and timing of corporate information becomes an additional concern in the process.

A company whose primary concern is providing a liquid facility for the owners of its shares will want to see a relatively steady price with changes as continuous as possible. This is also likely to be the case where a company is buying in its own shares or seeking to acquire the shares of other companies. At the same time, however, excessive attention to liquidity at the expense of proper handling of corporate information can lead to a loss of the trust and credibility of investors. That event, in turn, can create the worst kinds of price discontinuities when the relevant information does finally come to light.

A company planning to sell new shares will focus on the ability of a market to price its stock as close to equilibrium value as possible. That way the financing can be maximized without exposing the buyers of the new shares to subsequent disappointments. Simultaneously, however, liquid market conditions around that equilibrium price are a necessary condition for holding down the cost of capital, or investors' required returns.

The uncomfortable conclusion of all this is that liquidity and efficiency are often incompatible characteristics of a market, desirable as each of them may be for economic efficiency and rational allocation of resources.

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