The puzzling decline in financial market liquidity[1]

Avinash Persaud, State Street

Market participants frequently complain about lack of market liquidity - the ability to get in and out of financial markets without driving the price against you. The worrying thing is that complaints of illiquidity are even levelled against the largest markets, the smooth functioning of which have economic importance. Consequently, illiquidity and the resulting dislocation of markets, also worries central bankers. The foreign exchange market, for example, is the largest market by turnover - daily turnover is an estimated $1.8 trillion - or 20 times that of the New York stock exchange. But on 28 February 2000, the euro fell 5% against the yen in five hours as the market absorbed a modest sale of euros. The difference between hedging foreign exchange exposure that morning or afternoon could have wiped out a year's profit margin for a typical exporter. Previously, as turnover was the only observable measure of liquidity and markets have grown rapidly, complaints about liquidity have generally been put down to a few freakish events and investors being unwilling to give up hard-earned returns to market makers. However, new data analysed below suggests investors' tight hold has been well founded and that, in many markets, liquidity never recovered from the body blows of 1998. It would appear that the forces that are sapping market liquidity are growing inadvertently aided unsuspectingly, by the activities of unsuspecting regulators.

Liquidity - measured by the price-impact of trading

There are few measures, but many different meanings, of liquidity. In a macroeconomic sense, liquidity often refers to interest rate or money supply conditions influenced by a central bank. In a microeconomic sense, liquidity refers to the ability or cost of transacting in markets. The two concepts are related but separate and it is the latter meaning of liquidity, the cost of transacting, that I wish to focus on. Poor liquidity equates to large transaction costs which limit the size and growth of markets and is likely to result in a loss of economic welfare. In most financial markets, transaction costs comprise commissions and the price impact of trading - how sensitive prices are to an additional purchase or sale. As commissions are typically fixed or move with market conditions (which are proportional to price-impact of trading), a good measure of changing liquidity conditions is simply a measure of the price impact of trading. What exactly does this mean?

In liquid conditions, all else being equal, the decision by one section of the market to sell the euro on one day should not drive the euro lower. The co-movement of flows and prices - or, put another way, the price impact of selling - should be small. On another day, when liquidity conditions have worsened, the same sale might drive the euro down and have a bigger price impact. To reveal this shift in liquidity conditions, one needs to observe not just the development of prices, but underlying gross transactions. This has not been done before because, while price data is available, reliable and representative, flow data was not - until recently.

Using State Street's $6.2 trillion of portfolio holdings data - about 12% of the world's tradeable securities - Froot, O'Connell & Seasholes (1999) have calculated a daily measure of the price impact of buying or selling of foreign securities faced by cross-border investors in 42 countries. Correlations between State street's portfolio flow data and, where available, official data range from 0.70 to 0.80 in major markets, suggesting that the data is representative. In essence, their methodology involves regressing returns on contemporaneous cross-border investor buys and sells. The coefficients on buys and sells are published as the Liquidity Index. The regression equation takes into account the timing of trades, the "anticipation effect" and outliers (see FDO Partners & State Street Bank, 2000). The results challenge many assumptions. In terms of the price impact of trading foreign equities, the liquidity faced by cross-border investors is substantially lower today than in 1997. In emerging markets, liquidity conditions are even lower than during the turmoil of 1998.

[1] This was previously published in the June 2000 edition of Risk Magazine.

The declining path of liquidity

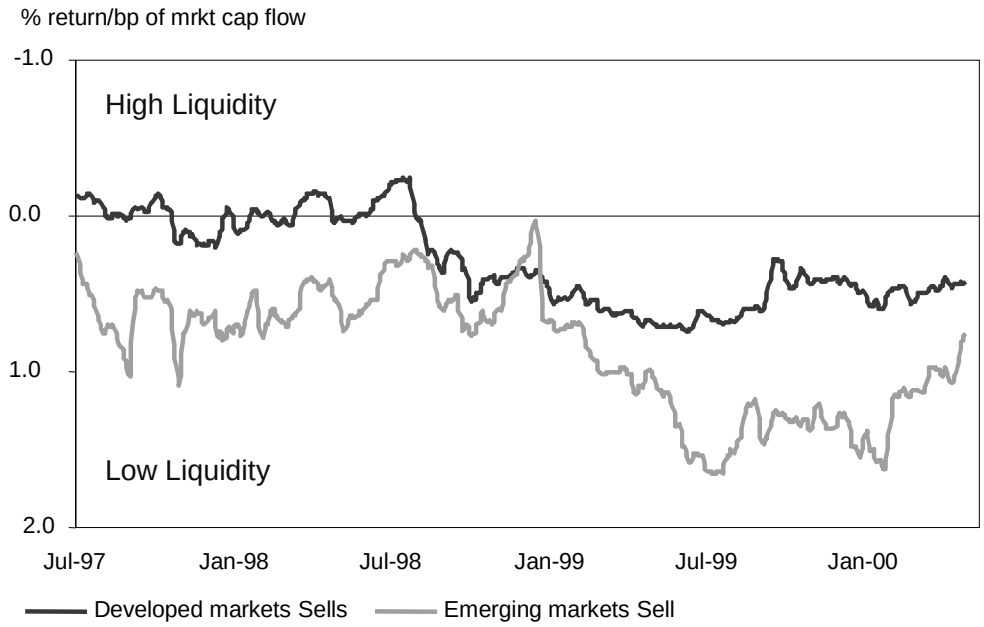
Up to June 1997, liquidity was high in both developed and emerging markets for cross-border investors. From that point, emerging market liquidity started a long decline. This decline accelerated after the South Korean "devaluation" in November 1997, received a temporary boost at the time of the three interest rate cuts by the US Federal Reserve and talk of new lending facilities for the International Monetary Fund, and then slumped back ahead of year 2000 computer concerns in 1999. The crisis in Korea appears to have had a more systematic impact on flows and liquidity than the previous devaluations in Thailand, Indonesia and Malaysia.

It was only just before the Russian crisis in August 1998 that liquidity conditions started to turn down in developed markets. Developments in South Korea and Russia proved systemic. Year 2000 concerns appear to have been concentrated on emerging markets, having little liquidity impact on developed markets. While the US Federal Reserve Bank's interest rate cuts at the end of 1998 offered some temporary respite for liquidity in emerging markets and arguably offset the impact of the collapse of the hedge fund, Long-Term Capital Management, it appears to have been less successful in supporting liquidity in developed markets, see Chart 1.

Chart 1

Liquidity index for emerging and developed markets
- a measure of the price-impact of trading

(based on State Street's $6 trillion of portfolio holdings data)



Markets are bigger and thinner

The decline of liquidity across developed and emerging markets contrasts strongly with the sharp rebound in foreign security prices in 1999, for both developed and emerging markets. It also contrasts strongly with recovering portfolio flows since October 1998 and growing turnover in the foreign exchange market. The net decline in cross-border portfolio flows in developed and emerging markets between late 1997 to October 1998 was reversed by June 1999, in the case of developed markets. Flows returned, but liquidity did not.

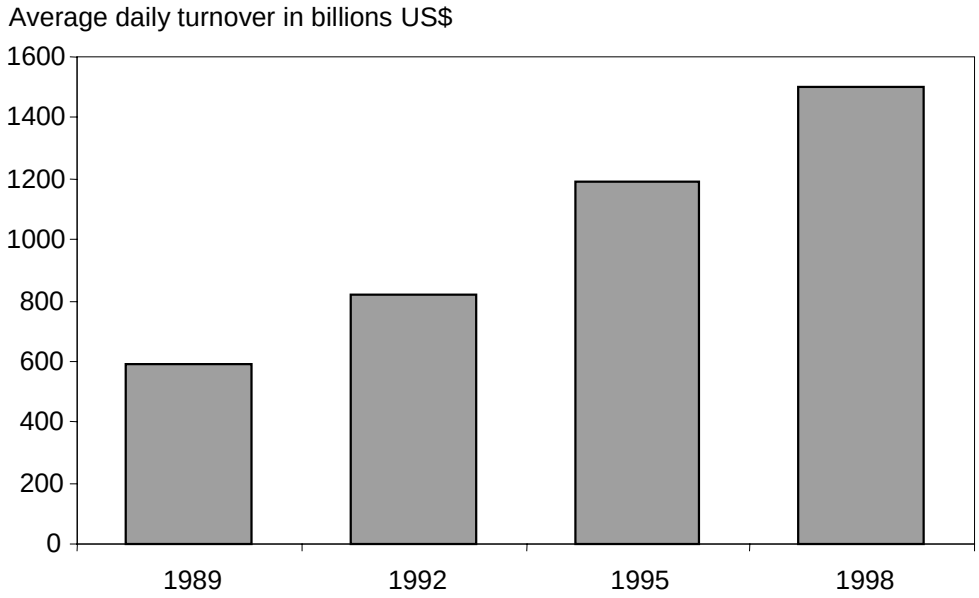
Explaining the liquidity puzzle

There are three factors that may explain this liquidity puzzle. First some have argued that liquidity may have been hindered by the uncertainty attached to two one-off factors: the arrival of European economic and Monetary Union (EMU) in January 1999 and the anticipation of the year 2000 "bug" in January 2000. We have seen that the latter may have impacted liquidity in emerging markets. But

EMU should have been a force for increased liquidity in the securities markets and, although foreign exchange turnover may have been 5-10% higher without EMU, foreign exchange turnover has not actually fallen. It is hard to explain this decline in liquidity by one-off factors alone.

Chart 2

Daily turnover in the foreign exchange market



ECNs and electronic broking

A second factor drawing liquidity has been the rise in the number of exchanges, or perhaps more accurately, the rise in the number of different ways of transacting, such as electronic alternative trading systems (ATS) and electronic communication networks (ECNs). ECNs such as Instinet and Island have recently taken a large part of the market share of trading on the Nasdaq (the world's second largest equity market) and Electronic Broking System has established a significant share of the foreign exchange markets. These systems operate well and reduce costs when markets are large and participants have different views. As a result they draw liquidity away from outside these systems. However, when markets are small or participants adopt the same view, no one is obliged to make a market on the crossing network or broking systems so liquidity vanishes and little is left outside those systems to help. Given the economic importance of liquidity, regulators and central bankers ought to pay more attention to supporting the development of liquid exchanges without harming innovation. There is a growing demand for liquidity. Pension fund managers initially rejoiced at the recent announcement of the merger of the London Stock Exchange with the Deutsche Bourse principally because of the liquidity benefits.

More herding, less liquidity

The third, related factor is that markets are increasingly driven by herding investors. Two decades ago, international capital flows were strongly related to international trade and banking flows that helped to finance the shortfalls. One decade ago, absolute return investors taking bets on currencies and bond markets played an important role in boosting liquidity. Today, international capital flows are driven by institutional investors seeking better returns than their competitors.

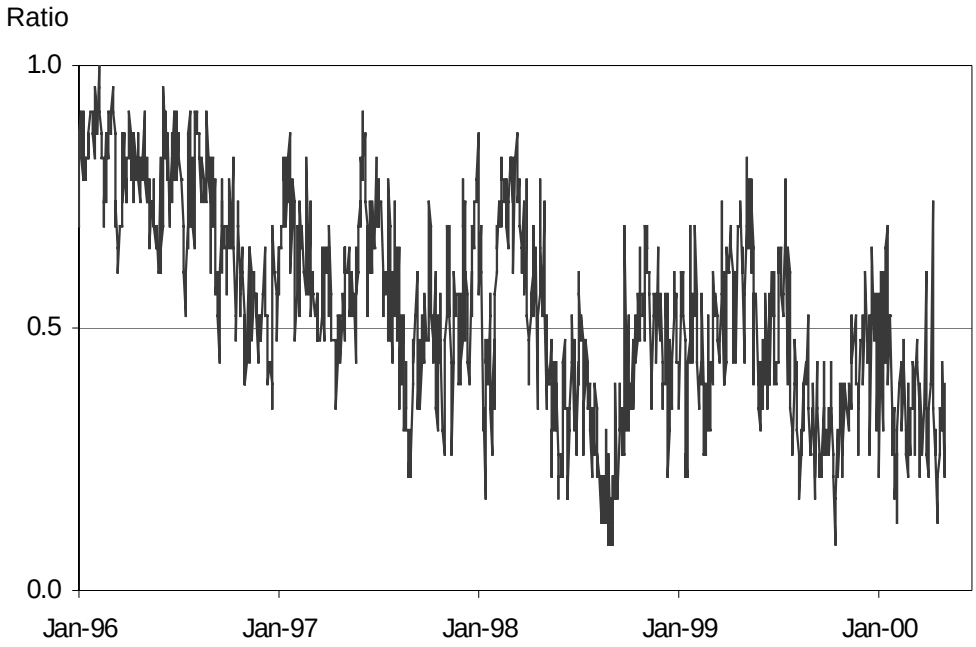
There is plenty of theoretical support and empirical evidence that relative-return investors behave like a herd, rushing in and out of markets together. Increasing the size of the herd does little to support liquidity, indeed it could reduce it. If everyone is trying to enter or exit the door at the same time, having more people do so doesn't make it easier to squeeze past. One measure of the herd is portfolio flows across 23 emerging markets. Although these 23 markets exhibit very different economic

fundamentals, politics and markets, there are times when all 23 markets are receiving net inflows as in most of 1996 when buying emerging markets was all the rage, or in late 1998, when almost all 23 were receiving net outflows. Chart 3 shows the ratio of the number of emerging market countries receiving net cross-border inflows over the previous month (or more precisely, rolling 20 business days). This ratio can be used as a measure of investors' preference or aversion to risk more generally.

Chart 3

Ratio of emerging markets receiving net cross-border inflows

(based on State Street's $6 trillion portfolio holdings data)



Risk management may make matters worse

To some extent, the combination of herding investors and tighter risk management systems has aggravated liquidity conditions. Herding investors hit their risk management limits together, causing them to sell the same markets together, reducing liquidity and causing those markets to exhibit even greater volatility than in the past, which in turn feeds back into risk management systems and leads to further sales. Thus, the cycle becomes self-feeding. In these environments, markets need contrarian investors able to run sizeable losses and buy near the bottom in the hope that they will be the first to benefit from the turnaround. Interestingly, unregulated, hedge funds are more likely to do this than regulated investors and banks. Indeed, given that such hedge funds are putting the risk capital of wealthy professionals at risk (and not the life savings of the average person in the street), they are eminently suitable for this task.

Hedge funds may support liquidity

The irony is that, by pressuring counterparties to insist on greater disclosure and tougher collateral requirements, regulators have been discouraging the kind of hedge funds that make big macro bets. In the process, they may have damaged market liquidity which in turn has made it more difficult for these hedge funds to operate. It is noteworthy that the pattern of liquidity faced by cross-border institutional investors in emerging markets follows very closely the dwindling size of macro hedge funds. This process has recently enveloped the twin icons of the hedge fund industry, Julian Robertson and George Soros.

Regulators need to examine how to achieve the right balance of regulation and provide support to liquidity. Given that herding by institutional investors continues, that ECNs and ATSs are growing in number and that big macro hedge funds are on the defensive, one can expect liquidity to remain in

scarce supply. Consequently, the managing of liquidity will become increasingly important for every participant in financial markets. With this in mind, and armed with this new set of daily data on liquidity in 41 different markets (Froot, O'Connell & Seasholes, 1999), State Street intend to initiate a regular series of research on liquidity, its path, its drivers and key changes.

Avinash Persaud, Global Head of Research

Summary of methodology

The Liquidity Index (see main text) was produced by FDO partners, LLC and State Street Bank. State Street Bank is the world's largest custodian with more than $6.2 trillion of assets under custody. The Liquidity Index is based on daily cross-border transactions data, collected by State Street Bank & Trust. From the universe of total daily transactions, State Street separates out only those transactions that originate in one country but settle in another currency - cross-border portfolio flows.

The methodology involves regressing returns on contemporaneous buys and sells. The coefficients on buys and sells from the regression are published as the "Liquidity Index - a measure of the price impact of trading". The regression specification takes into account the timing of trades, the "anticipation effect" and outliers.

This measure is both a measure of liquidity faced by cross-border investors and a measure of whether cross-border flows are "driving" the current direction of a market or not. Either interpretation can be justified.

Adjustment to the data

Timing of trades, anticipation effects, outliers

In order to take into account the fact that a trade can take place in the same day but across several time zones, each day's data is actually the average of returns on that day and the preceding day.

Earlier work by Professor Ken Froot et al has shown that State Street's portfolio flows have predictive power for future equity returns. To try to isolate the contemporaneous price impact of trades, this correlation is controlled for by including lagged terms of buys and sells in the regression specification.

A single outlier can cause coefficients to shift wildly, as the outlier enters the rolling window used to estimate the regression and when it leaves. In order to reduce these distortions outliers are removed in the following way. Each day, for each country, the amount of bought and sold (as a fraction of market capitalisation) is compared to the mean buy or sell trades over the past trading days. Any point that is more than four standard deviations away from the mean is replaced with the mean.

Regression equation

To estimate the price impact cost, we run a regression of returns on contemporaneous buys, contemporaneous sells, lagged buys, lagged sells and a constant.

$$R_{i,t} = \alpha_i + \theta_{B,i} Buy_{i,t} + \theta_{S,i} Sell_{i,t} + \Lambda_{B,i} Buy_{i,t-p} + \Lambda_{S,i} Sell_{i,t-p} + \varepsilon_{i,t}$$

where:

$R_{i,t}$ = the average daily return of market "i" over the week from "t–(p+1)" to "t"

$Buy_{i,t}$ = the average fraction of market capitalization of market "i" bought by clients of State Street Bank over the week from "t–(p+1)" to "t"

$Sell_{i,t}$ = the average fraction of market capitalization of market "i" sold by clients of State Street Bank over the week from "t–(p+1)" to "t"

The two parameters of interest are:

$\theta_{B,i}$ parameter related to the price impact of foreign buying

$\theta_{S,i}$ parameter related to the price impact of foreign selling

We expect the parameter $\theta_{B,i}$ to be positive most of the time, indicating that foreign purchases happen contemporaneously with price increases. During periods when the price impact costs of buying are high, the $\theta_{B,i}$ parameter will be more positive than during times when the price impact costs are low.

Likewise, we expect the $\theta_{S,i}$ parameter to be negative, indicating that foreign sales happen contemporaneously with price decreases. During periods when the price impact costs of selling are high, the $\theta_{S,i}$ parameter will be more negative than during times when the price impact costs are low. Here because the $\theta_{S,i}$ parameter is multiplied by –1, it will be reflected into the positive y-axis.

The magnitude of the parameters depends on a number of factors including State Street's share of foreign trading in a particular market and the units that the flows and returns are recorded in (eg decimal form, percentages, basis points, etc). We express returns (in USD) in percentages (multiply them by 100) and flows in basis points of market capitalization (multiply them by 10,000).

Contemporaneous correlation

Returns are highly correlated in markets around the world. To account for this correlation, we estimate a system of regression equations and allow for correlation between the residuals. For one region or country, we have:

$R_{i,t} = \alpha_i + \theta_{B,i} Buy_{i,t} + \theta_{S,i} Sell_{i,t} + \Lambda_{B,i} Buy_{i,t-p} + \Lambda_{S,i} Sell_{i,t-p} + \varepsilon_{i,t}$

which can be written more succinctly: $Y_i = X_i \beta_i + \varepsilon_i$

We then stack a series of regions or countries:

$$\begin{bmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_N \end{bmatrix} = \begin{bmatrix} X_1 & 0 & \cdots & 0 \\ 0 & X_1 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & X_1 \end{bmatrix} \begin{bmatrix} \beta_1 \\ \beta_2 \\ \vdots \\ \beta_N \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_N \end{bmatrix}$$

$$\Sigma = \begin{bmatrix} \sigma_{11} & \sigma_{12} & \cdots & \sigma_{1N} \\ \sigma_{21} & \sigma_{22} & \cdots & \sigma_{2N} \\ \vdots & \vdots & \ddots & \vdots \\ \sigma_{N1} & \sigma_{N2} & \cdots & \sigma_{NN} \end{bmatrix}$$

The GLS estimator is:

$$V = \Sigma \otimes I_N$$

$$\hat{\beta} = \left[X' V^{-1} X\right]^{-1} X' V^{-1} Y$$

The GLS estimator $\hat{\beta}$ is actually a vector of region or country parameters $\hat{\beta} = \left[\hat{\beta}_1, \hat{\beta}_2, \ldots, \hat{\beta}_N\right]'$ where each region or country parameter is $\hat{\beta}_i = \left[\hat{\alpha}, \hat{\theta}_{B,i}, \hat{\theta}_{S,i}, \hat{\Lambda}_{B,i}, \hat{\Lambda}_{S,i}\right]'$. Again, we are interested only in the parameter estimates of $\left\{\hat{\theta}_{B,i}, \hat{\theta}_{S,i}\right\}$ which represent the contemporaneous co-movement of prices and flows.

All regions and countries are unable to be estimated together because regions are linear combinations of countries

For further detail see, Liquidity Index - Technical Document, FDO Partners LLC & State Street Bank, April 2000.

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