Liquidity Buckets, Liquidity Indices, Liquidity Duration and their Applications to Hedge Funds

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Liquidity risk is the financial risk due to not being able to pull one's money out of an investment instantaneously without market impact (ie, not having perfect liquidity).

A well-established fact from classical finance is that investors expect a premium, or liquidity premium, for investing in more illiquid assets [Damodaran 2002]. Hedge funds should not be exempt from providing a liquidity premium and one should not mistake the liquidity premium for alpha (Bhaduri, AllAboutAlpha.com 2007).

Mistaking illiquidity for alpha

Consider the following:

- Hedge Fund A has a two-year lock-up with annual redemption and trades in illiquid instruments.
- Hedge Fund B has no lock-up with monthly redemption and trades in liquid instruments.
- Both hedge funds have a five-year track year.

It is incorrect to merely compare the statistics (return, volatility, skew, kurtosis, omega, etc) of these two funds. Hedge Fund B allows the investor to get out of the investment sooner and this has a value that does not appear when one calculates the statistics. Due to the illiquidity and lock-up, Hedge Fund A should be furnishing a better statistical return. One needs to quantify the value of liquidity in order to make a fair statistical comparison. Otherwise, it really is comparing apples to oranges. One should not mistake the illiquidity of Hedge Fund A with alpha. Portfolio managers must ensure that they are being properly compensated to take on the illiquid assets.

Portfolio managers who merely compare statistics of Hedge Fund A and B are essentially giving the liquidity premium a value of zero. While one knows (or should know) that liquidity has a value, Bhaduri and Whelan demonstrated via the 'Balls in the Hat' game, that it is easy to underestimate the value of liquidity (Bhaduri & Whelan 2008).

In Emanuel Derman's August 2006 paper 'The Premium for Hedge Fund Lock-ups', he calculated that the risk premium for a two-year lock-up over a one-year lock-up is approximately 1% and approaches a constant of 3% for longer lock ups (Derman 2006).

One may apply an option-pricing methodology into portfolio management in order to try to take liquidity differences into account (Krishnan & Nelken 2003 and Whelan & Bhaduri 2008). However, these techniques, though useful, can sometimes be difficult to implement.

Liquidity buckets

Liquidity buckets furnish a simple yet useful way for portfolio managers to assess their portfolio through a liquidity lens.

The methodology for liquidity buckets is as follows:

1. List the investments in ascending order via liquidity.

2. Partition this list into liquidity buckets.

3. Calculate the average statistics over a common time interval for each of the liquidity buckets.

The above is a blend of art and science — one obviously does not want to make the partition too fine (ie, too many buckets) or too coarse (ie, too few buckets). By comparing the statistics of the liquidity buckets, the portfolio manager is able to see what empirical value of liquidity the book is achieving. One would expect a higher return in the buckets that contain investments that are less liquid. One can also compare the risk-adjusted returns of each of the buckets and the correlation between the returns of the different buckets. If the buckets that contain less liquid instruments do not perform as well, it would tend to suggest that the portfolio is not being adequately compensated for taking on less-liquid positions. In addition, when examining new potential investments, one can quantitatively compare the potential investment to the statistics of the appropriate liquidity bucket. Liquidity buckets are easy to implement and should be able to offer some immediate insights into portfolio performance, attribution and construction. Indeed, statistical comparison between the different liquidity buckets gives an approximation for the empirical value of the liquidity premium.

The most natural application for liquidity buckets is to allocators — fund of hedge funds (FoF), family offices, pensions and endowments — they can, and should, measure how well they are being paid to take on liquidity risk. Liquidity buckets may also be applied at a more micro-level as well; hedge funds that have different trades would have to come up with a liquidity score based on each of the types of trades that they are doing across different instruments. After the fund has created the different liquidity buckets based on these scores, attribution analysis may be conducted to include how the different buckets perform.

Liquidity buckets may also help in pricing liquidity derivatives. Liquidity derivatives, a powerful new concept for mitigating liquidity risk (Bhaduri, Meissner & Youn 2007), have not yet been utilised by the financial industry.

Liquidity performance Indices

It is industry convention for a hedge fund analyst conducting due diligence on a hedge fund to give a comparison on performance to the respective hedge fund strategy of a hedge fund index. For instance, if analysing a convertible arbitrage hedge fund, it is natural to compare the hedge fund's performance to a leading hedge fund index. Hedge fund index providers are partitioning the universe of hedge funds via different strategies, and then calculating the return on each of the respective strategies. This service allows a hedge fund analyst to quantitatively compare the performance of a hedge fund to an appropriate hedge fund strategy index. In an analogous fashion, these index providers may partition their hedge fund universe with liquidity buckets. This will allow hedge fund analysts to look through a liquidity lens by comparing a hedge fund candidate's statistics to that of the appropriate liquidity performance index. Returning to the example in the previous section, this will correct the mistake of merely comparing the statistics of Hedge Fund A and B with no regard toward the redemption terms.

Liquidity duration

While the importance of liquidity is often mentioned, few liquidity metrics are wide-stream in portfolio and risk management (Bhaduri & Kaneshige 2005).

Liquidity duration is a metric that may be used to better understand the liquidity of a FoF portfolio. The basic premise of liquidity duration is to answer the question, if one were to put a dollar into a FoF today, on average, how much time until one is able to take it out based on the redemption terms of the underlying funds in the FoF's portfolio?

More precisely, liquidity duration is captured by the following equation:

$$\text{Liquidity duration} = \sum w_{i} * TB_{i}$$

where the summation is taken over the different liquidity buckets (B_i) and the time associated with each bucket is multiplied by the respective allocation weights of funds in that bucket.

A simple example helps to illustrate this definition.

Example

Consider a FoF that has allocated 40% of its assets to funds that have no lock-up and a monthly redemption, 20% allocated to funds that have no lock-up and a quarterly redemption, 20% allocated to funds that have a yearly lock-up and monthly redemption, and 20% allocated to funds that have a two-year lock-up and semi-annual liquidity. Then:

Liquidity duration = 0.4*(1/12) + 0.2*(1/4) + 0.2*(1) + 0.2*(2) = 0.683 months

One could adjust the liquidity duration to factor in the 'live-through' of a lock-up, but this is not as conservative and, due to the fact that most offering memorandums are crafted to be in the favour of the hedge fund manager with regards to redemption terms, it is better not to make the 'live-through' adjustment. Alternatively, the precision of the liquidity duration can be dialed up by including gates in the calculations.

The liquidity duration metric may be tracked through time and helps to avoid a liquidity mismatch. Decomposing the portfolio into liquidity buckets and doing a weighted sum of these buckets helps to give a more concise understanding of the portfolio's liquidity terms.

Recent hedge fund performance under a liquidity lens

Methodology

1) Managers from Hedge Fund Research's hedge fund universe were sorted alphabetically in ascending order and duplicate funds (funds with multiple share/fee classes) were removed.

2) The remaining funds were sorted by lock-up period and then sorted by redemption notice period.

3) The funds were then organised into 'buckets' — groups of funds with the same lock-ups and varying redemption notice periods — and divided into sub-buckets of redemption notice periods.

4) Manager's returns were weighted equally in each bucket — giving no unfair advantage to the larger hedge funds.

5) Statistical analysis was performed on each bucket (and sub-bucket) to see if differing liquidity terms offer better or worse returns.

Results

The lock-ups were divided into four groups:

All lock-ups (from June 2004 – June 2007)

Lock-up (years)	Three-year cumulative	Annualised ROR	Standard deviation	Skew	Kurtosis	Number of managers
0 ≤ Lock-up < 1	43.50%	12.79%	4.35%	-0.48	-0.42	1,416
1 ≤ Lock-up < 2	46.81%	13.66%	4.84%	-0.33	-0.07	443
2 ≤ Lock-up < 3	79.12%	21.44%	5.90%	-0.24	-0.14	29
3 ≤ Lock-up	42.26%	12.47%	5.29%	-0.73	0.51	16
All	**44.48%**	**13.05%**	**4.50%**	**-0.46**	**-0.38**	**1,904**

The two larger buckets were further divided into four sub-groups:

Less than one year lock-up (from June 2004 – June 2007)

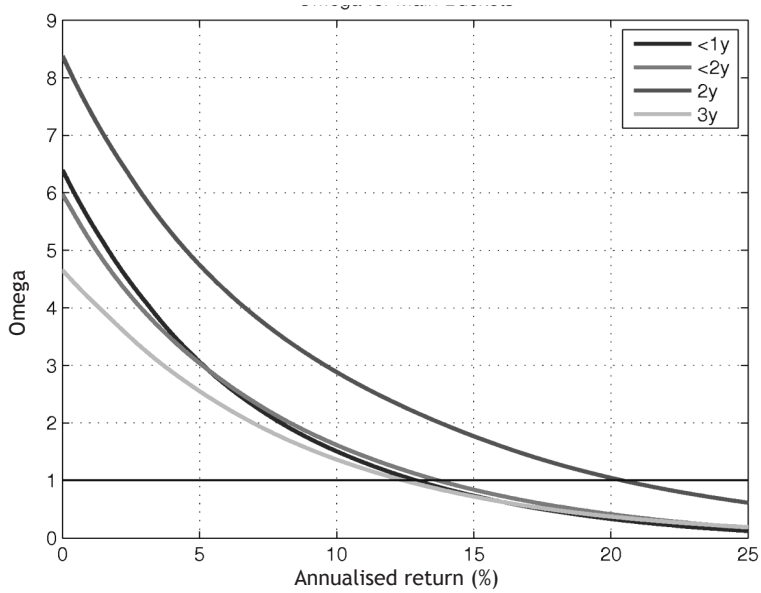
Redemption (months)	Three-year cumulative	Annualised ROR	Standard deviation	Skew	Kurtosis	Number of managers
<=1	42.27%	12.47%	4.43%	-0.45	-0.49	968
<=3	46.50%	13.57%	4.38%	-0.52	-0.32	327
<=6	43.30%	12.74%	3.80%	-0.22	-0.09	87
<=12	50.42%	14.58%	5.55%	-0.17	-0.68	34
All	**43.50%**	**12.79%**	**4.35%**	**-0.48**	**-0.42**	**1,416**

Less than two year (greater than one year) lock-up (from June 2004 – June 2007)

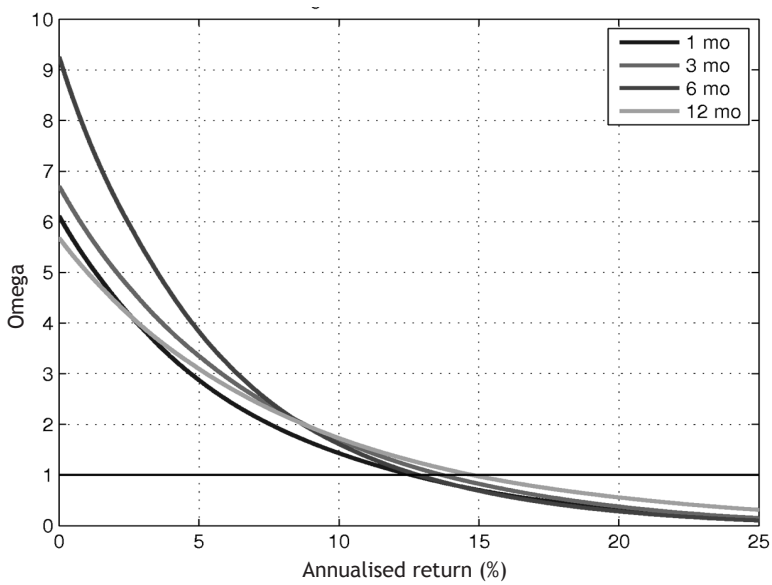
Redemption (months)	Three-year cumulative	Annualised ROR	Standard deviation	Skew	Kurtosis	Number of managers
<=1	44.31%	13.01%	4.52%	-0.03	-0.19	85
<=3	47.27%	13.77%	4.97%	-0.33	-0.02	276
<=6	44.10%	12.95%	5.47%	-0.58	-0.05	32
<=12	50.25%	14.53%	4.83%	-0.50	-0.09	50
All	**46.81%**	**13.66%**	**4.84%**	**-0.33**	**-0.07**	**443**

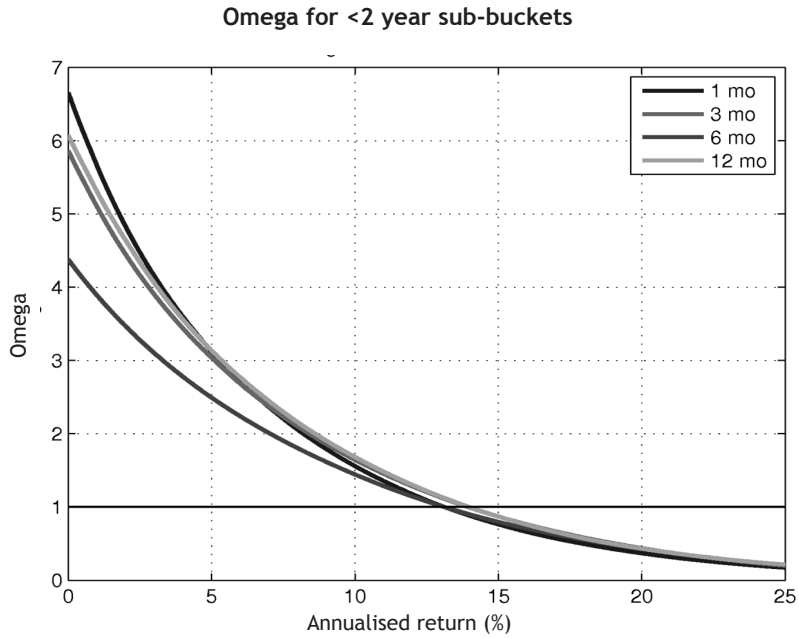
Omega graphs of results

Omega for main buckets



Omega for <1 year sub-buckets





Analysis of results

The data illustrates that the return is not strictly increasing with the lock-up. Indeed, the three-year lock-up bucket had the worst return among the major buckets; however, one has to be somewhat careful about this result, since the three-year bucket is only 16 data points (whereas the universe as a whole is comprised of 1,904 unique investment funds). Annualised returns within less than one-year or less than two-year buckets show no trend, returns are dispersed almost randomly throughout each liquidity bucket. The skew and kurtosis within these buckets are similar as well. In general, results may be more spurious when there are fewer funds in a bucket, as outliers will have a greater effect.

When looking at sub-buckets within the larger two buckets, an interesting phenomenon occurs: within the less than one-year lock-up bucket, longer redemption periods do not give a return premium. In fact, the annualised premium paid for the less than two-year lock-up over the less than one-year lock-up is only 87 basis points (bp). This premium becomes negligible when compared to the premium paid within one bucket and varying sub-buckets.

The Omega graphical analysis supports the above summary (for a review of the Omega function, please see Bhaduri & Kaneshige 2005).

Each liquidity bucket contains a diverse mix of strategies and asset classes. Thus, the argument that one might still choose to invest in an illiquid bucket since it has investments with low correlation to the rest of the book and adds to the diversification, is one which rings hollow. One may find ample diversification in the more liquid buckets.

All of the above statistical analysis has been done disregarding the possibility that some of the more illiquid funds may have smoothed some of their results. If one wishes to get more technical, then one may consider invoking the robustness coefficient in the Omega analysis (Bhaduri & Meissner, 2008).

It is clear that there has been an alpha decay for funds of longer lock-up since the study that Derman conducted. Derman conducted his study on the time interval 2000-2005.

Conclusion

The hedge fund universe has expanded rapidly to the point that there are hedge funds on the continuum spectrum from mutual funds to private equity (see Bhaduri, May 2007). It is in the interest of most hedge fund managers to advocate a longer lock-up and say that it is a good thing, but the investor must make sure that they are being properly compensated for that lock-up. The fact that most hedge funds take a management fee while invoking a lock-up also leads to a game-theoretic incentive to gather assets.

It is true that if the lock-up is longer, then it gives the hedge fund manager a wider domain of investments to explore that are less liquid (because a portfolio manager must always be concerned about a liquidity mismatch). Thus, a hedge fund that trades in illiquid instruments is prudent to have more stringent redemption clauses (or else it will leave itself vulnerable to a liquidity mismatch). While a hedge fund manager might claim that having a wider domain of trades available through a longer lock-up adds to the flexibility at which he may extract alpha, once money gets deployed in longer illiquid trades, there is less flexibility for the portfolio manager to actually manage the book.

Moreover, some hedge fund managers are invoking longer lock-ups simply because they may and, in many cases, investors are not getting properly compensated for having their money tied up. Furthermore, in a liquidity crunch, it might be the liquid investments that are unloaded, simply because one is forced to get cash and cannot get out of the less desirable illiquid investments.

Hedge funds that have the opposite type of liquidity mismatch (trade liquid instruments but have onerous redemption terms) often claim that they are trying to avoid the 'hot money' of FoFs. However, hedge fund managers always retain the right to refuse a potential investor, so that does not really wash. Furthermore, if they are truly trading liquid instruments, then it should not really make very much difference if a client redeems. Some hedge fund managers will argue that the lock-up forces the investor to ride out drawdowns, instead of selling at the bottom in fear (and looking for some place with hotter returns to chase). However, if the investor is so un-savvy, then perhaps their decision to enter into the hedge fund to begin with was a poor one. Finally, if they are delivering the risk-adjusted returns that they promised, then the probability of investors wanting to pull their money out is low. The bottom line is, if the redemption terms are more onerous, one should expect a higher return. This is independent of the time horizon of the investor. More precisely, even if the investor has a long time horizon and does not anticipate redeeming, she should be properly compensated for having her money tied up. This goes back to the value of liquidity, as well as the opportunity cost of not having dry powder should an unexpected attractive opportunity arise.

It is generally true that there are less hidden risks in trading more liquid instruments. This statement is worth repeating and also reveals the relationship between liquidity risk and model risk. In general, the less liquid the instruments that are traded, the more hidden risk and the more dangerous model risk becomes. The recent credit crisis is a great example of this statement. Valuation issues do not occur on exchange-traded instruments. This is part of the appeal of liquid hedge funds, such as commodity trading advisers (CTAs), to sophisticated and prudent investors.

Hedge funds have not been compensating investors with a liquidity premium and, in some cases, have been delivering negative liquidity premium. This is rare in finance, though not without precedence; from the early 1980s until the late 1990s the term structure of interest rates for long maturities in Chile was usually downward sloping (see Fernández 2005).

This article has introduced the concepts of liquidity buckets, liquidity duration, and liquidity performance indices — all of which may be used by portfolio and risk managers to gauge how well they are managing liquidity and to help measure the empirical value of liquidity that they are achieving. These tools will help investors in determining if they are being properly compensated by hedge funds which have lock-ups. It was also demonstrated that recently (June 2004 – June 2007) hedge funds with more onerous lock-ups have not performed statistically better than those with less onerous lock-ups. It should be noted that this data analysis was done before the summer

2007 credit crisis started and that there have been many hedge funds with longer lock-ups in the structured credit space since that time, which have had significant problems and poor returns. Thus, one would expect that this result of longer lock-ups underperforming has become even more pronounced.

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Endnotes

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