

Portable Alpha: Using Hedge Funds to Beat Market Indexes

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In the broadest sense, portable alpha encompasses an array of investment approaches for earning higher return by combining the alpha generating techniques found in one or several asset classes with the index return of another asset class. One of the earliest, and still prevalent, examples is combining the alpha generating skills of a short duration bond manager with S&P 500 Index futures to create an active equity management product. Investment firms BlackRock, PIMCO, Western Asset Management and others have been purveyors of this portable alpha application.

Individual hedge funds have also gotten involved. Jack Meyer, the former head of Harvard Management Company, offered investors in his start-up hedge fund, Convexity Capital, the choice of several portable alpha options. They could take the hedge fund's returns as is, or they could select share classes that combine the same hedge fund returns with returns on the S&P 500, Russell 2000, MSCI EAFE, or Treasury bond indexes. All investors would have their assets placed in a lower risk hedge fund vehicle intended to produce excess returns over T-bills. But those investors selecting, for example, the MSCI EAFE Index share class would also have their hedge fund assets combined with MSCI EAFE Index swaps. The intended portable alpha result would be the selected index return plus whatever excess return was produced by the hedge fund.

Why are investors turning to portable alpha applications when they are seemingly more complex and, consequently, potentially vulnerable to unfamiliar risks? The reason is simple. Investors of all sizes and types have failed to earn returns above index levels the old fashioned way through traditional long-only managers. At the very least, portable alpha is different and investors can't be criticized for repeating past failures. Of course, another option is to just index all assets, but that simple answer may not be feasible because most strategists' forecasts for stock and bond index returns are below investor long term objectives.

Two reasons are prompting investment in portable alpha, or at least taking a hard look. The first is the success that hedge funds have achieved in producing excess return or alpha with little or no exposure to the larger market risks found in the equity and bond market indexes. This performance success is why hedge funds today have the highest growth of any asset class. The second reason is increased investor familiarity and comfort with the use of derivative instruments, such as futures and swaps, that are the tools used to transfer alpha from one asset class to another.

Lastly, investors are implementing portable alpha strategies because they have been very successful. Endowments were the earliest users of portable alpha strategies. Harvard University is perhaps best known for using portable alpha. Others include the Universities of Virginia, Richmond, Duke, and Tufts. Retirement plans use it less often but those that do have reportedly had good success. Corporate pension plans that use portable alpha include BP Amoco, Eastman Kodak, and Weyerhaeuser. Public pension plans that have significant allocations to portable

alpha include the states of Massachusetts, Pennsylvania, and Missouri. Each has produced fund level returns that rank at or near the top of industry performance rankings.

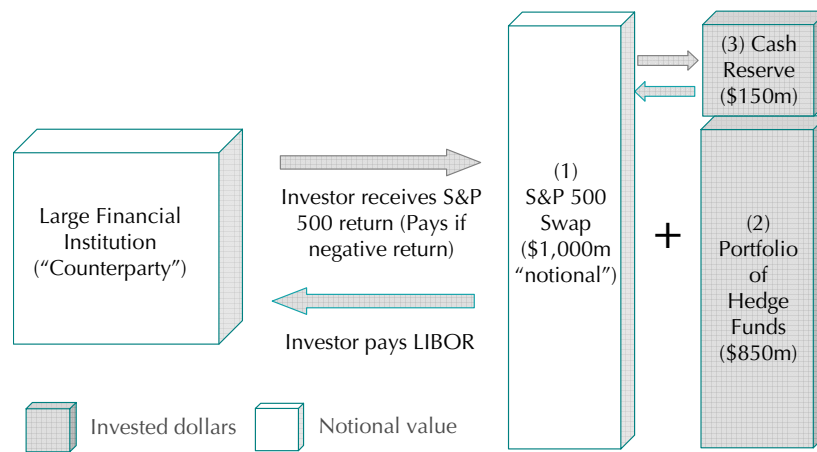
How Portable Alpha Works

Exhibit 1 diagrams an example of how a large \$1 billion portable alpha portfolio might be constructed using a diversified portfolio of hedge funds as the source of alpha and a swap agreement as the source of S&P 500 Index return. In this example the institutional investor creates the portable alpha portfolio rather than investing in a number of portable alpha products. Most investors find this approach preferable because, unlike Convexity, most of the best hedge funds (alpha sources) don't create portable alpha products.

The portable alpha portfolio in Exhibit 1 has three components that together would replace a traditional \$1 billion index fund or group of active equity managers:

1. an S&P 500 Index swap agreement with a “counterparty” requiring no initial cash investment,
2. an \$850 million portfolio of hedge funds or fund-of-funds, and
3. a \$150 million cash reserve to meet possible swap payments if the S&P 500 Index return falls below LIBOR.¹

Exhibit 1: Structure of a One Billion Dollar Portable Alpha Program



In the swap agreement, a large financial institution “as counterparty” pays quarterly a dollar amount equal to the S&P 500 Index return times the notional value of the investment, in this example \$1 billion. In return, the investor agrees to pay an amount equal to three month LIBOR times the same \$1 billion notional value. Payments are netted quarterly, leaving the financial institution paying the investor the S&P 500 Index return net of LIBOR, or the investor paying the financial institution if the S&P 500 Index return is below LIBOR for the quarter.

S&P 500 Index returns vary significantly quarter to quarter and consequently so will quarterly swap receipts and payments. Most portable alpha investors set up a cash reserve to absorb quarterly swap receipts or to make swap payments. In Exhibit 1, the cash reserve is initially set at 15% of total assets, or \$150 million, an allocation that will provide for sufficient liquidity

(investor payments) should a worse case decline in the S&P 500 Index occur. The cash reserve is invested in a short term cash equivalents, through a commingled or separate account.

The final piece of the portable alpha portfolio is the \$850 million investment in a diversified portfolio of hedge funds or hedge fund-of-funds. This hedge fund segment is intended to provide alpha while the swap agreement and cash reserve provide beta.

Exhibit 2 provides an accounting of expected return and risk for the portable alpha portfolio that demonstrates why portable alpha is an attractive alternative to traditional managers and index funds.

Exhibit 2: Expected Return and Risk for Portable Alpha Portfolio

		Expected Return	Expected Risk*
<u>A. Swap Agreement:</u>			
	1. Investor receives S&P 500 Index Return (Swap Agreement)	8.00%	17.00%
<i>minus</i>	2. Investor pays LIBOR return (Swap Agreement)	<u>-3.35%</u>	<u>1.00%</u>
<i>equals</i>	3. Expected Swap Agreement Return and Risk	4.65%	16.93%
<u>B. Investments:</u>			
	4. Hedge Fund Portfolio return (7.15% on 85% of assets)	6.08%	3.94%
<i>plus</i>	5. Cash Reserve return (3.35% on 15% of assets)	<u>0.50%</u>	<u>0.15%</u>
<i>equals</i>	6. Expected Return and Risk on Invested Assets	6.58%	4.01%
<u>(A.3 plus B.6) Portable Alpha Portfolio:</u>		11.23%	17.87%
<i>minus</i>	7. Expected S&P 500 Index return	<u>-8.00%</u>	<u>17.00%</u>
<i>equals</i>	8. Expected Portable Alpha Excess Return and Risk	3.23%	0.87%

* Unlike expected return, expected risk does not always add and subtract due to low correlations.

Section A contains return and risk estimates for the S&P 500 swap agreement. In A.1 the investor receives the S&P 500 index return, which has an expected value of 8.00% annually with a standard deviation of 17.00%. These and other return and risk assumptions are discussed in Appendix A. The investor agrees in A.2 to pay LIBOR, which has an expected value of 3.35% annually with a 1.00% risk level. In A.3 the netted payment to the investor is expected to be 4.65% annually at an expected risk level of 16.93%.

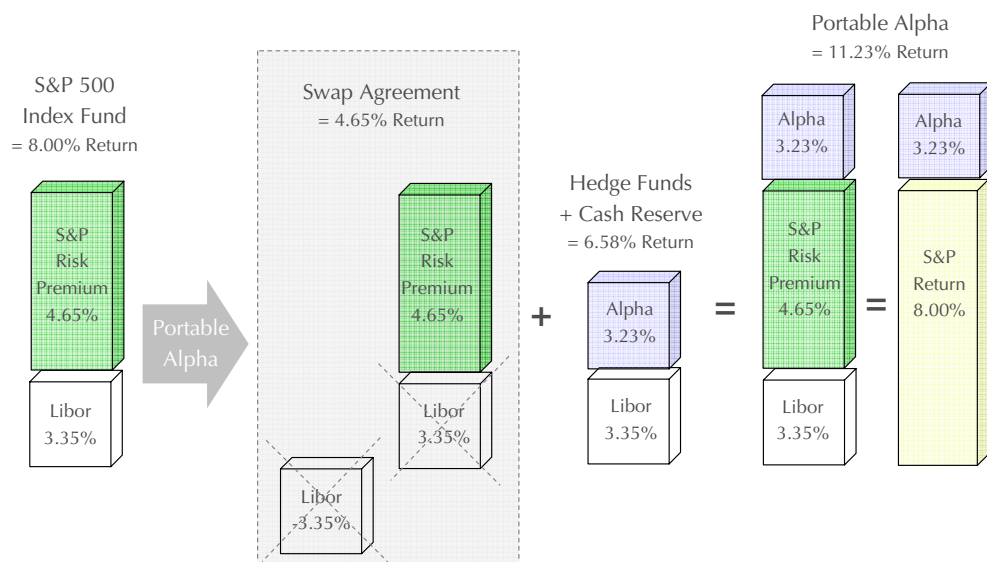
The physical (cash), as opposed to notional, investments in the portable alpha portfolio are shown in Section B. The hedge fund portfolio in line B.4 is expected to earn a 7.15% annual return (see Appendix A for a description of assumptions). However, since only 85% of the \$1 billion portfolio is invested in hedge funds, the return on the total portable alpha portfolio from hedge funds is 6.08%. The expected risk level is 3.94%, which equals 85% of the 4.64% risk assumption for hedge funds alone. The expected return and risk contribution of the cash reserve is 0.50% and 0.15%, respectively, diminished by the low 15% weighting in the portable alpha portfolio. B.6 contains the expected return and risk from the combined \$1 billion investment in hedge funds and cash reserves: a 6.58% expected return and 4.01% expected risk.

The portable alpha portfolio is a combination of returns and risks in Sections A.3 and B.6. Its expected return is 11.23%, which is 3.23% (line 8) per year above the 8.00% expected return on

the S&P 500 Index. The expected risk for the portable alpha portfolio is 17.87%, only marginally higher than the 17.00% expected S&P 500 Index risk. The reason the portable alpha portfolio risk is not higher is that the correlation between the portfolio of hedge funds and the S&P 500 Index is assumed to be 0.15, which produces significant diversification benefits. But while total risk for the portable alpha portfolio is only slightly greater than the S&P 500 Index, many investors look at “tracking error”, the standard deviation of excess returns above or below the Index, as another important risk measure. The expected tracking error for the portable alpha portfolio given our assumptions is 3.64%. The information ratio for the portable alpha portfolio is 0.89, equal to expected excess return of 3.23% divided by a tracking error of 3.64%.

Exhibit 3 provides another perspective on how portable alpha expected returns add up.

Exhibit 3: The Arithmetic behind Portable Alpha



The leftmost bar shows the expected 8.00% S&P 500 Index total return divided into its 3.35% LIBOR rate and 4.65% “equity risk premium”, the expected added return for taking on equity risk. The portable alpha architecture begins with the swap agreement, represented by the two bars in the gray shaded region. By agreeing to pay LIBOR and receive the S&P 500 return the investor expects the swap agreement to return only the 4.65% S&P risk premium over time. The payment of LIBOR per the agreement offsets the LIBOR (risk-free) component implicit in the expected S&P 500 Index return. The portable alpha assets are invested in hedge funds and a cash reserve. As described in Exhibit 2, together the assets are expected to earn a 6.58% annual return, of which 3.35% represents the risk-free LIBOR rate and the remaining 3.23% is alpha.

Either of the two rightmost bars represents the combined portable alpha portfolio. The first represents the sum of the 4.65% S&P 500 risk premium from the swap, the 3.35% LIBOR and the 3.23% alpha components from the invested assets in hedge funds and cash reserve. Their sum is 11.23%, the total return for the portable alpha portfolio. Alternatively, since the S&P 500 risk premium and LIBOR together equal the S&P 500 Index return, the 11.23% portable alpha return equals the 8.00% S&P 500 Index expected return plus the 3.23% alpha.

Having covered the broad concepts underlying portable alpha, we consider below some of the details, including what could go wrong.

The Swap Agreement

A key design aspect of portable alpha is receiving index returns without actually investing assets in an index fund, which can be achieved through either index futures or swaps. Swaps are used in our example because they require a smaller cash reserve, which is discussed later. However, futures contracts are acceptable and have their own advantages.

Swap agreements are still very unfamiliar territory for endowment and retirement plan trustees and consequently a potential obstacle to portable alpha portfolios that need their approval. This education gap is somewhat surprising since swap agreements had a worldwide notional value of \$402 trillion at June 30, 2007, of which \$10 trillion – the equivalent of the S&P 500 market capitalization – represented equity index swaps like those used in our portable alpha example.² Interest rate and currency swaps remain the largest segments of the swap market but both credit default swaps and equity swaps are growing rapidly.

ISDA

Somewhat surprising is that so little is reported about a market that is so large and that will potentially be viewed by the press as risky, given the ability to use swaps to leverage returns. This is partially because swap agreements are privately negotiated contracts, unlike financial futures which are exchange traded, with price movements and volume are reported daily. Equity index futures began trading in 1983 with the S&P 500 index futures contract on the Chicago Board of Trade. The first equity index swaps originated in the late 1980s. The growth in index swaps got a big boost in 1992 when the International Swaps and Derivatives Association (“ISDA”) developed a set of standard documentation for swap agreements. ISDA is a global trade association started in 1985 for the purpose of assisting the privately negotiated derivatives industry. Its membership today includes 815 of the largest financial institutions across 56 countries.

The four documents comprising a swap agreement are:

- The ISDA Master Agreement
- The Schedule To The ISDA Master Agreement
- The Credit Support Annex to The Schedule To The Master Agreement, and
- Trade Confirmation

The ISDA Master Agreement contains non-economic terms such as representations and warranties and events of default and termination. The benefit of The ISDA Master Agreement is its legal authority across countries and markets. Any modifications to The ISDA Master Agreement are contained in a supporting document called The Schedule To The ISDA Master Agreement. The Schedule often includes modifications to notice periods, documentation, and changes to definitions of default and remedies. Frequently, swap counterparties agree that financial obligations generated by the swap agreement may grow to a level that warrants additional credit protection, either through collateralization or partial settlement. The Credit Support Annex specifies what conditions trigger the need for credit enhancement and if collateralization is required, what types of assets are acceptable. Finally, the Trade Confirmation is used to specify economic terms such as reference index, amount, price, and maturity for each

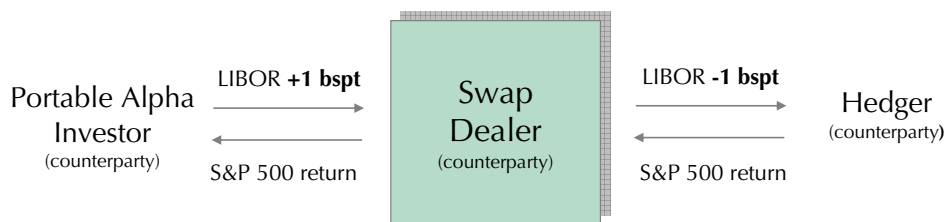
swap transaction. The ISDA documentation set gives swap counterparties the desired level of standardization and flexibility that represent an advantage over exchange traded futures contracts in many transactions.

Swap Dealers

Swap agreements involve two private counterparties of equal legal standing who agree to periodically exchange uncertain and potentially large profits or losses based upon indexes or individual security returns. Consequently, the wherewithal of the counterparties to make timely payment on the potential obligations generated by the swap agreement will be a crucial consideration in entering into the swap. In the futures market, a well capitalized exchange clearinghouse is counterparty to all futures contracts, thereby giving investors assurance that contract obligations will be met. In return, the futures clearinghouse protects itself from investor default by requiring the investor to post collateral and settle any gains or losses daily. Unlike futures, the swap market has no clearinghouse. Instead, a group of large, highly rated, and well capitalized financial institutions serve a similar role by taking on a pricing and principal role in most swap agreements. These “swap dealers” include JP Morgan, Goldman Sachs, Morgan Stanley, UBS, Credit Suisse, and Bear Stearns.

Swap dealers make money by pricing their swaps to earn a small spread on offsetting transactions, as illustrated in Exhibit 4. In this illustration the swap dealer is a counterparty to a portable alpha investor who seeks S&P 500 Index returns and agrees to pay LIBOR plus 1 basis point. The swap dealer is not interested in leaving in place a “short” position in the S&P 500 and seeks to find an offsetting swap agreement. He finds a hedger – perhaps a hedge fund – that wants to reduce equity exposure and agrees to a swap that pays the S&P 500 Index return to the swap dealer in return for payments of LIBOR minus 1 basis point. From the perspective of the swap dealer, the net result of the two agreements is 2 basis points on the total notional amount of the offsetting swaps. Two basis points may seem small, but considering that the total notional value of swaps is \$400 trillion, this activity could be a very good business.

Exhibit 4: A Dealer’s Offsetting Swap Agreements



The illustration also reflects that swap dealers earn money by charging small spreads and do not act as speculators on the direction of the stock or other markets.

S&P 500 Swap Portfolio Construction

An S&P swap will typically have a one year maturity (tenor) with quarterly payments (resets). Payments are netted so that one payment is made from the swap dealer to the investor if the S&P 500 return exceeds three month LIBOR – plus or minus a negotiated spread – or from the investor to the swap dealer if the S&P 500 return falls below three month LIBOR. No principal is

exchanged between the investor and dealer/counterparty. Some portable alpha investors choose to negotiate and structure the swaps themselves while others hire outside advisors to do the work.

In our example, a single \$1 billion S&P 500 Index swap is possible but not desirable for several reasons. While swap dealers carry high credit ratings (A- or better), credit risk still exists and should be diversified across several financial institutions. Secondly, it is important to stagger swap agreement maturities so that the entire \$1 billion swap is not vulnerable to disadvantageous pricing (a high spread to LIBOR) when the agreement matures. Finally, a major reason for using swaps over futures is that swaps generally require less liquidity or cash reserve because short term swap losses arising from a declining S&P 500 Index can potentially be partially or completely reversed over the three month swap reset period. Liquidity needs can be further reduced if, for example, three swap agreements are used with quarterly resets occurring at different month-ends. One swap agreement would have January, April, July, and October resets. The second would have February, May, August, and November resets. The third would have March, June, September, and December resets. Cash reserve needs would be minimized if one-third of the total \$1 billion notional value of the S&P 500 overlay were allocated to each of the three swaps in the example.

Index Selection and Swap Costs

Alpha from a portfolio of hedge funds can be combined with most traditional market indexes either through index futures or swaps. The S&P 500 Index is the most popular, but investors can also use the Russell 1000, 2000, 3000 Indexes, the MSCI EAFE Index, the Lehman Aggregate Bond Index, and 5- or 10-year Treasuries. Basically, any index that trades on a futures market is a candidate for portable alpha. The reason the S&P 500 Index is most popular with portable alpha programs is that 1) it is the cheapest to implement, 2) large capitalization stocks are generally considered the most efficient capital market and therefore a good portable alpha candidate, and 3) US large capitalization stocks represent the largest fraction of institutional portfolios.

Generally, equity swaps and futures can be exchanged for quarterly rates within a few basis points – positive or negative – of three month LIBOR. US equity indexes like the S&P 500 and Russell 1000 would be examples. Swap overlays for the MSCI EAFE or Lehman Aggregate Indexes are more expensive. For example, to get the MSCI EAFE Index return, an investor might have to pay 15 to 25 basis points annually in addition to LIBOR. For the Lehman Aggregate Index, the spread over LIBOR is even higher, at 25 to 40 basis points. However, at times swap costs can be surprisingly low. The Russell 2000 swap has been priced at 25 to 30 basis points *below* LIBOR over the last few years.

A Portable Alpha Example

Stock market performance, whether positive or negative, is immediately reflected in the value of a traditional index fund or stock portfolio. In the case of a portable alpha portfolio, stock market performance is reflected through net cash inflows (when the S&P 500 return exceeds LIBOR) or net cash outflows (when the S&P 500 return is below LIBOR) to the portable alpha portfolio, as required by a swap agreement or futures contract. A cash reserve is generally included as part of a portable alpha portfolio to absorb cash inflows or pay outflows. How the swap agreement generates cash flows between the swap broker and the cash reserve was illustrated in Exhibit 1. The example in Exhibit 5 might further clarify this dynamic. The example also illustrates how the notional size of the swap or futures overlay changes to accommodate changing asset values.

Suppose at year-end 2007 the investor negotiates a one year \$1 billion S&P 500 swap at no spread to LIBOR and with quarterly settlements (resets) to overlay on an \$850 million hedge fund portfolio and \$150 million cash reserve. Exhibit 5 shows three quarters of activity that illustrate how cash flows and asset values might transpire and their effects on portable alpha performance.

During the first quarter, the S&P returns -5%, the cash reserve earns a 1% LIBOR return, and the hedge fund portfolio also happens to earn a 1% return. The 1% hedge fund portfolio return is somewhat disappointing since it needs to exceed the 1% quarterly LIBOR in order for the portable alpha portfolio to generate an excess return above the S&P 500 Index.

The swap agreement calls for the investor to pay LIBOR to the swap dealer/counterparty and receive the S&P 500 Index return. Since the S&P 500 return is negative, the investor ends up paying a total of \$60 million, \$50 million from the S&P 500 Index loss and another \$10 million based upon LIBOR. The investments earn a total of \$10 million for the quarter, \$1.5 million on the cash reserve and \$8.5 million on the portfolio of hedge funds. At March 31, total portable alpha assets are \$950 million for a quarterly return of -5%, the same as the S&P 500 return. First quarter performance illustrates the fact that a portable alpha portfolio will mirror the performance of the S&P 500 as long as the hedge fund portfolio – the alpha source – earns precisely the LIBOR rate. It also shows that the -5% S&P 500 quarterly loss shows up in a decline in the cash reserve from \$150 million to \$91.5 million.

With a reduced \$950 million portable alpha portfolio at March 31, the notional swap agreement should be of equal size. The mechanics of equity swaps is that the notional value changes as the total return changes. Therefore the new notional swap size automatically becomes \$950 million (\$1 billion times 0.95) as the second quarter begins.

Exhibit 5: Example Quarterly Assets & Flows for Portable Alpha (in \$millions)

	Dec 2007		Mar 2008		June 2008		Sept 2008
	Assets	Flow	Assets	Flow	Assets	Flow	Assets
A. S&P Swap Agreement*	\$0.0	(\$60.0)	\$0.0	\$0.0	\$0.0	\$19.5	\$0.0
B. Investments							
Cash Reserve	\$150.0	\$1.5	\$91.5	\$0.9	\$92.4	\$0.9	\$112.9
Hedge Funds	\$850.0	\$8.5	\$858.5	\$25.8	\$884.3	\$0.0	\$884.3
(A+B) Total	\$1,000.0	(\$50.0)	\$950.0	\$26.7	\$976.7	\$20.5	\$997.1
Quarterly Total Returns:							
S&P 500		-5.0%		1.0%		3.0%	
Cash (LIBOR)		1.0%		1.0%		1.0%	
Hedge Funds		1.0%		3.0%		0.0%	
Total Portable Alpha		-5.0%		2.8%		2.1%	
* Notional Swap Value	\$1,000.0		\$950.0		\$976.7		\$997.1

The S&P 500 Index earns a 1% return during the second quarter, equal to 1% LIBOR. Consequently, there is no cash flow from the swap agreement as the S&P 500 and LIBOR payments are exactly offsetting. Hedge funds have a much better second quarter, returning 3.0% and which can be viewed as consisting of 1.0% LIBOR plus a 2.0% excess return, or alpha. The total portable alpha portfolio is 2.8% or 1.8% higher than the S&P 500 Index. These second quarter results illustrate how excess return from the hedge fund portfolio (2.0%) over LIBOR is

transformed into excess return over the S&P 500 Index (1.8%), reduced by 0.2% because 10% of assets (\$91.5 million divided by \$950.0 million) earned no excess return.

The new asset value at June 30 has climbed back up to \$976.7 million from \$950.0 million. The drop in the first quarter asset value required no action to reduce the notional swap allocation from \$1 billion to \$950.0 million because notional swap sized automatically change with the Index return. However, for the second quarter the change in notional value of the swap increases only by 1%, the return on the S&P 500 Index, to \$959.5 million. The remaining increase of \$17.2 million to \$976.7 million comes from hedge fund performance and therefore will not be included in the existing swap agreement as of the start of the third quarter. The investor or advisor must enter into a new additional swap agreement with a \$17.2 million notional value or, what is more likely, enter into S&P 500 index futures contracts equal to \$17.2 million. Futures contracts are often more convenient administratively for small adjustments to notional index exposure, especially when they are likely to continue month to month. However, for ease of presentation, we assume that the notional size of the swap agreement is increased to \$976.7 million at June 30.

The third quarter provides an example of how the portable alpha portfolio will underperform the S&P 500 Index return when the hedge fund portfolio return falls short of LIBOR for the quarter. The hedge fund portfolio for the first time underperforms LIBOR, earning 0.0% versus 1.0% for LIBOR. The S&P 500 Index climbs 3.0% and, net of the 1.0% LIBOR, the swap return is 2.0% for the third quarter. The result is a net positive cash flow from the swap agreement of \$19.5 which, coupled with a \$0.9 million return on the \$92.4 million cash reserve, increases the cash reserve to \$112.9 million at September 30. Hedge fund values remain unchanged due to the 0.0% quarterly return. The total portable alpha portfolio increases from \$976.6 million to \$997.1 million, for a quarterly return of 2.1%, which is below the 3.0% S&P 500 Index return for the third quarter.

The three quarter example demonstrates the arithmetic of portable alpha. Alpha is generated relative to the S&P 500 Index according to how the hedge fund portfolio performs relative to LIBOR, though reduced by the allocation to the cash reserve. While the cash reserve provides an important liquidity function, most portable alpha investors design their portfolios to keep cash reserves at a minimum so as to maximize alpha over the Index.

The Cash Reserve

A key design feature for any portable alpha portfolio is the size of the cash reserve to provide for swap/futures net cash flows, but especially cash outflows when the index return underperforms LIBOR. Most portable alpha investors assume that timely liquidity can not come from the hedge funds due to notice periods and other withdrawal restrictions. On the other hand, investors generally have access to other liquid assets (index funds, fixed income, public equities, etc.) that can be accessed in a severe market downturn. Ultimately, each portable alpha investor needs to assess their unique circumstances when setting the level of cash reserves.

An examination of past market declines provides a useful starting point in understanding potential portable alpha cash needs. Exhibit 6 lists 10 time periods since 1980 when S&P 500 Index performance, minus LIBOR, would have been its worst and would have caused the largest portable alpha cash outflows.

Exhibit 6: Impact of Stock Market Drawdowns on Portable Alpha Cash Outflows

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Start Date*	End Date*	Number of Months	S&P 500 Return	LIBOR	Difference or "Drawdown"	Single Swap Strategy	Staggered Swap Strategy
Mar-00	Mar-03	36	-41.04%	11.08%	-52.12%	-50.21%	-48.54%
Aug-87	Nov-87	3	-29.55%	1.93%	-31.48%	-31.48%	-16.29%
Nov-80	Sep-81	10	-13.84%	12.64%	-26.48%	-19.82%	-13.03%
Nov-81	Jul-82	8	-12.40%	8.04%	-20.44%	-14.41%	-13.77%
May-90	Oct-90	5	-14.70%	3.32%	-18.03%	-11.93%	-10.38%
Jun-98	Aug-98	2	-15.35%	0.92%	-16.27%	0.00%	-4.51%
Nov-83	Jul-84	8	-6.89%	6.25%	-13.15%	-12.03%	-11.55%
Jan-80	Mar-80	2	-9.58%	2.11%	-11.69%	0.00%	-0.77%
Jan-94	Jun-94	5	-6.54%	1.77%	-8.32%	-6.71%	-4.56%
Dec-99	Feb-00	2	-6.76%	0.98%	-7.74%	0.00%	-0.57%

* End of month dates

The 10 time periods in Exhibit 6 are identified in the first three columns and are ranked by the size of the “drawdown” in column 6. Drawdown is defined as the difference between the S&P 500 Index (column 4) return and LIBOR (column 5) and represents returns for the S&P 500 overlay portion of the portable alpha portfolio, whether implemented through futures or swaps. Column 6 also represents the net cash flow impact on the portable alpha portfolio if the S&P 500 overlay was implemented through futures contracts. Futures contracts settle daily – nothing is allowed to accrue – and therefore Index returns are translated into equivalent cash flow daily. As such, there are six time periods listed in Exhibit 6 where cash outflows from futures contracts would have exceeded an initial 15% cash reserve. Sometime during those periods cash reserves would have been completely depleted, and the investor would have had to access liquidity from other portfolios to provide for cash outflows. For example, the largest futures outflows were during the extremely severe stock market decline from March 31, 2000 to March 31, 2003. A \$1 billion portable alpha portfolio would have had outflows of \$521.2 million. Since, per the earlier example, only \$150.0 million was invested in the cash reserve, the investor would have had to find another \$371.2 million from other portfolios. If the portable alpha portfolio represented 5% of total assets prior to the market drawdown, the investor would have had to find other sources of liquidity equal to 1.9% of the total portfolio, based on beginning asset values.

The bursting of the Internet Bubble that precipitated the 2000 to 2003 stock market decline was a unique event. Market declines of that magnitude have occurred on average only once in every 25 years, the previous one being the 1973-1974 bear market. While investors should be prepared, such an event should be viewed as very rare. The second worst stock market decline was the October 1987 stock market crash, though in our back test we begin one month earlier, at August 31, 1987, because the S&P 500 Index fell modestly in September. This downturn is considered by many to also be a very unique event due to its severity and brevity, and would have resulted in cash outflows equal to 31.48% of the portable alpha portfolio if the S&P 500 overlay was implemented through futures contracts. As with the prior example, the investor would first deplete the 15% allocated to the cash reserve and then have to find liquid assets outside the portable alpha portfolio for the remaining 16.48% cash outflow.

Most portable alpha portfolio investors use swap agreements instead of futures contracts because they potentially reduce cash outflows, though returns are not affected. This is possible because

swap payments are made quarterly whereas futures contracts settle daily. As a result, market losses might not need to be settled when using swaps if they are offset later by market gains. Column 7 in Exhibit 6 illustrates the potential cash flow benefits if a single swap is used instead of futures contracts. Note that in all but the two worst case time periods in the first two rows the single swap agreement materially reduces cash outflows and in three instances eliminates outflows entirely.

Swap agreements generally do not materially reduce cash outflows during prolonged market downturns, such as the three year period ending March 31, 2003. Cash outflows totaled 50.21% for the single swap strategy, only slightly lower than the 52.12% outflow if futures were used. The single swap strategy was also not much help during the October 1987 stock market crash. The market downturn lasted exactly three months, equal to the reset period on the swap.

Column 8 in Exhibit 6 illustrates cash outflows for a more common three swap strategy described earlier where the total notional amount of the portable alpha portfolio, \$1 billion, is divided into three equal swaps of \$333 million with different reset calendars. This swap configuration has much better success in controlling cash outflows. In fact, the 15% cash reserve would be sufficient in all but two stock market declines, and in the October 1987 stock market crash the outflow is 16.29%, which would require a very small 1.29% cash need for liquid assets outside the portable alpha portfolio. If the portable alpha portfolio were 5% of total assets, a 1.29% cash need would represent just 6 basis points, or 0.06% of total assets.

The back tested returns show that a 15% reserve and a staggered three swap overlay is sufficient to provide for most potential cash outflows from an S&P 500 Index portable alpha portfolio. Only very rare market occurrences would necessitate a need to tap liquidity from assets outside the portable alpha portfolio itself. In fact, investors who have ample other assets in liquid form may want to consider cash reserve levels lower than 15%. Another consideration when sizing the cash reserve is the choice of index. Indexes with lower volatility would presumably require a smaller cash reserve.

Swap Counterparty Risk

Counterparty risk is another important element in managing swap agreements, and it refers to the possibility that the swap counterparty can not meet the swap payments under the agreement. Best practice has the investor negotiate agreements with several swap counterparties in order to get the best pricing and to diversify credit exposure. While most counterparties are highly rated, AIG's accounting problems, Refco's management fraud and more the more recent troubles at Bear Sterns, Citibank, and Merrill Lynch demonstrate that counterparty credit risk is important and diversification should be considered. In addition to diversifying counterparties among highly rated institutions, another approach that is available with ISDA agreements is to specify in a "Credit Annex" the conditions whereby collateral must be posted by the obligated counterparty. For example, counterparties could be required to post collateral should accrued obligations under the swap agreements exceeds a specified dollar level. Such a provision, though sometimes viewed as administratively cumbersome, can be useful when potential exposure could be high and can not be diversified with multiple counterparties.

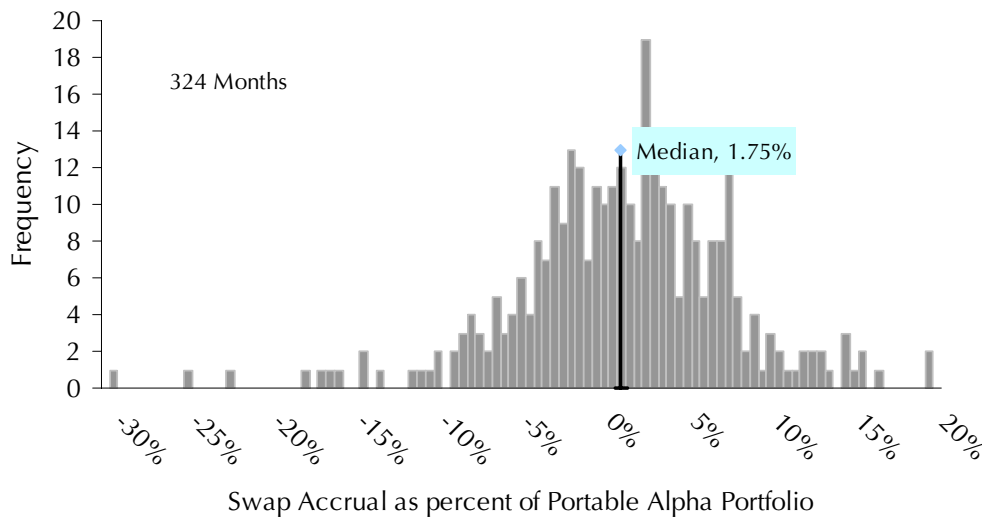
Highly rated financial institutions that are active swap providers include most major Wall Street firms. One factor that mitigates credit risk to the portable alpha investor is that the swap dealer's obligation would be highest when the equity markets do very well, an environment that is generally favorable to financial institutions. The credit worthiness of financial institutions would

more likely weaken during market disruptions where stock prices would fall. But under such a scenario there should be no credit risk for the portable alpha investor as net swap payments would favor the swap dealer. Swap agreements also should be competitively bid among several potential dealers. It is likely that this process over time will lend itself to multiple swap counterparties.

The dollar value at risk to the portable alpha investor from counterparty default equals any investment gains accrued between settlement payments as a result of S&P 500 index returns above LIBOR. The notional amount of the swap is not at risk, just the accrued three month gains, if any.

To gauge the possible magnitude of counterparty risk, monthly swap accruals were calculated in a back test of a portable alpha portfolio using a staggered swap overlay strategy for the 1980 to 2006 time period. Exhibit 7 shows a frequency distribution of the month end swap accruals expressed as a percent of the portable alpha portfolio. Positive values represent swap accruals owed by the counterparty (swap dealer) to the portable alpha investor. Negative values represent swap accruals owed by the investor to the swap dealer. The median historical value is 1.75%, meaning that the investor should expect (50th percentile) the month end swap accrual to be a positive 1.75% of the total portable alpha portfolio. If the portable alpha portfolio had a \$1 billion value, then the expected accrual would total \$17.5 million.

Exhibit 7: Counterparty Exposure (1980 to 2006)



The wide distribution of possible monthly swap accruals is a reflection of short term stock market volatility. Positive values represent credit exposure to the investor. There were two occasions when the swap accrual would have totaled 20% of the portable alpha portfolio, March 1987 and December 1998.

Is a 20% credit exposure acceptable? An initial reaction would be probably not though other factors need to be considered. The first is that the credit exposure has a very short maturity, not more than three months and most likely 30 days. This is quite different from the typical 10 year corporate bond. A second consideration is that the credit exposure should be viewed in the context of the total portfolio. If the portable alpha portfolio represents 10% of total assets, then the highest credit exposure produced by the swap will be 2% of total assets. Further, most

portable alpha portfolios of size diversify their swap counterparties. If three swap dealers were used, the maximum exposure to any one institution would be 6.7% of the portable alpha portfolio and 0.67% of total assets. Even if a default occurred, which historically is a remote possibility, likely losses on recovery would likely be small. Mentioned earlier as well is the unlikely scenario where a large financial institution would get into trouble at the same time that the S&P 500 Index was experiencing record gains. Also, most investors will find that greater credit exposure exists within their fixed income portfolio than will likely be exhibited in the swap accruals. Nonetheless, investors should exercise good judgment in selecting swap dealers, monitoring creditworthiness, and diversifying swap exposure across multiple high quality institutions.

The Portfolio of Hedge Funds

Not all hedge funds are suitable for a portable alpha program. Ideally, those selected should have no beta exposure so that only pure alpha, and not a mixture of alpha and beta, is combined with beta exposure from the swap overlay³. This would rule out most equity long/short hedge funds whose betas can be large.⁴

Exhibit 8 shows historical betas for major hedge fund style categories for the 10 years ending 2006. The betas are calculated through a multiple regression using six market based indexes as independent variables. The Russell 3000 Index is divided into two separate series, one when the return is positive (“Up”) and the other when the return is negative (“Down”). This separation is made because several arbitrage strategies used by hedge funds exhibit beta sensitivity only when markets decline.

Exhibit 8: Hedge Fund Betas: 1997 – 2006

(1) HFRI Style Indexes	(2) Portfolio Weight	(3) – (8) Statistically Significant Beta Coefficients					
		(3) Up R 3000	(4) Down R 3000	(5) MSCI EAFE	(6) MSCI EMF	(7) HYMT	(8) Int. Treas
Convertible Arbitrage	11.1%				-0.04	0.25	
Fixed Income Arbitrage	11.1%	-0.18				0.15	
Equity Market Neutral	11.1%			0.06	-0.05		0.17
Fixed Income: High Yield	11.1%	-0.10		0.09		0.40	0.22
Distressed	11.1%		0.12			0.32	
Event-Driven	11.1%	0.09	0.19	0.07		0.33	
Merger Arbitrage	11.1%		0.15			0.12	
Equity Hedge		0.30	0.32		0.12		
Macro	11.1%			0.11	0.09		0.67
Relative Value Arbitrage	11.1%		0.13			0.17	0.19
Fund Weighted Composite		0.17	0.26	0.08	0.08	0.12	
Fund of Funds Composite			0.15		0.07		
FOF: Conservative			0.07		0.04	0.09	
PA Hedge Fund Portfolio	100.0%			0.06		0.20	0.21

Indexes used as Independent Variables:

R 3000 is the Russell 3000 Index of the largest 3,000 U.S. companies by market capitalization.

MSCI EAFE is the index of developed non-U.S. equity markets.

MSCI EMF is the index of emerging non-U.S. equity markets.

HYMT is the return difference between the Lehman High Yield Bond Index and 10 year Treasuries.

Int. Treasuries is the return on the Lehman Intermediate Treasury Index.

The first column lists 10 major HFRI hedge fund style categories followed by three HFRI composite indexes. The Fund Weighted Composite is an equal weighted index of all reporting hedge funds. The Fund of Funds Composite is an equal weighting of all hedge fund-of-funds. The FOF Conservative Composite is an equal weighting of lower risk, low beta hedge fund of funds. The “Portable (PA) Alpha Hedge Fund Portfolio” at the bottom represents an equal weighting of 9 of the 10 hedge fund categories, with the HFRI Equity Hedge Index given a zero weighting. This PA Hedge Fund Portfolio reflects a straightforward approach to building a diversified hedge fund portfolio suitable for portable alpha by eliminating the one hedge fund style category with significant beta exposure to stocks.

Columns 3 through 8 report beta coefficients calculated over the 10 years ending December 31, 2006. Only betas that are statistically significant are shown. The ideal portfolio of hedge funds used for portable alpha would have no significant betas. Second best would be a portfolio with no significant equity beta if, as in our example, an S&P 500 Index swap is used as the overlay. The negative betas exhibited by the Fixed Income Arbitrage and Fixed Income-High Yield Indexes are significant but smaller. The problematic “Russell 3000 Up” and “Russell 3000 Down” betas are the 0.30 and 0.32 values, respectively, for the Equity Hedge Index. A portable alpha portfolio that includes a meaningful allocation to equity long-short hedge funds whose betas are captured by the Equity Hedge Index would be vulnerable to having too much stock beta when the beta found in the portfolio of hedge funds is combined with the equity swap beta. Simply eliminating equity long-short hedge funds from a portfolio, as is done in the portfolio constructed in the last row, will produce returns with no significant stock market beta.

Hedge fund-of-funds are sometimes used by investors instead of directly investing in hedge funds. While fund-of-funds vary in their investment strategies and composition, it is noteworthy that fund-of-funds indexes demonstrate less stock beta than what is found in the HFRI Fund Weighted Composite Index. Exhibit 8 reports significant up and down stock betas of 0.17 and 0.26, respectively, for the HFRI Fund Weighted Composite Index. The HFRI Fund-of-Funds Index does not have a significant stock beta when the market is up and a much lower 0.15 stock beta when the market is down. The HFRI FOF Conservative Index, which is comprised of fund-of-funds that are intentionally designed to be market neutral, has a statistically significant 0.07 stock beta when the market is down.

A portfolio of hedge funds may contain significant betas that are unrelated to the swap overlay. Portable alpha investors may have different views on their importance. The PA Hedge Fund Portfolio in Exhibit 8 has a very small 0.06 beta to the developed non-U.S. stock markets and betas of 0.20 and 0.21 to the high yield and Treasury bond markets, respectively. The credit and interest rate exposure that these betas suggest may be undesirable and the investor might want to cut back on hedge funds that have these beta tendencies.

Monthly alphas from traditional managers are generally normally distributed around their average value. This means that below average (or negative) alphas will be of the same magnitude as above average alphas. Many hedge fund styles produce returns that are not normally distributed which means that when they are used within a portable alpha portfolio, the resulting alphas or excess returns will not be normally distributed. Of particular concern would be a portfolio of hedge funds that produces negative alphas that are larger than positive alphas (negative skew) or have a higher than normal frequency of extreme alphas (excess kurtosis). Exhibit 9 shows three risk measures (standard deviation, skew, and excess kurtosis) for hedge fund style and composite indexes as well as for the Portable Alpha Hedge Fund Portfolio.

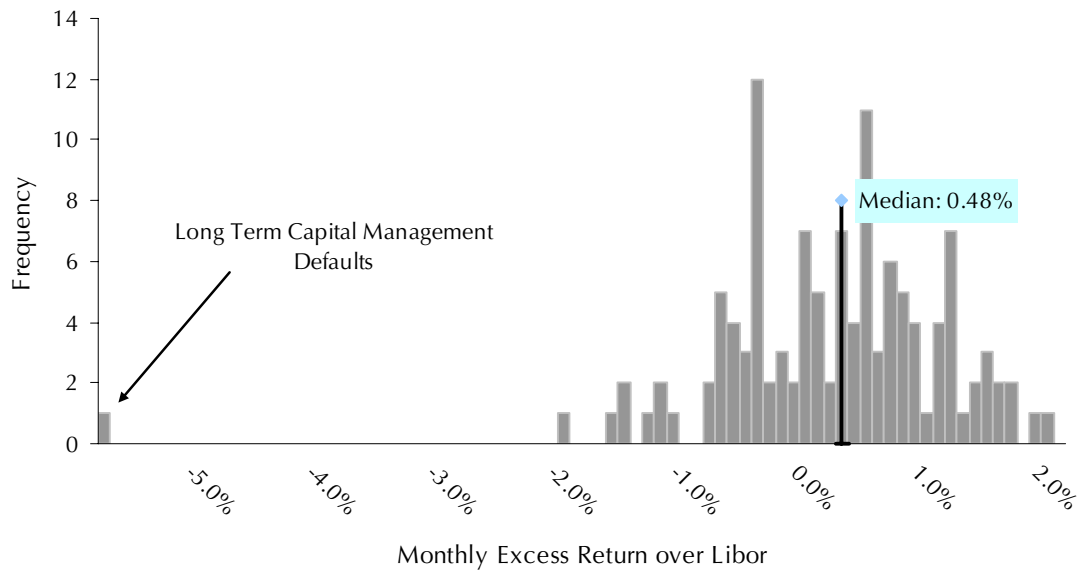
Exhibit 9: Hedge Fund Risk Measures: 1997-2006

	(1)	(2)	(3)	(4)	(5)
HFRI Style Indexes	Portfolio Weight	Standard Deviation	Skew	Excess Kurtosis	
Convertible Arbitrage	11.1%	3.47%	-0.88	2.26	
Fixed Income Arbitrage	11.1%	3.85%	-3.66	20.82	
Equity Market Neutral	11.1%	3.09%	0.48	1.22	
Fixed Income: High Yield	11.1%	4.55%	-2.18	9.97	
Distressed	11.1%	5.60%	-1.67	9.17	
Event-Driven	11.1%	6.63%	-1.33	5.39	
Merger Arbitrage	11.1%	3.88%	-1.94	8.58	
Equity Hedge		9.33%	0.39	1.97	
Macro	11.1%	6.45%	0.52	0.98	
Relative Value Arbitrage	11.1%	3.19%	-2.93	20.71	
Fund Weighted Composite		7.37%	-0.43	3.11	
Fund of Funds Composite		6.01%	-0.24	4.63	
FOF: Conservative		3.40%	-0.38	3.99	
PA Hedge Fund Portfolio	100.0%	3.35%	-1.84	9.92	

Standard deviation measures the volatility of hedge fund returns. The standard deviation of Portable Alpha Hedge Fund Portfolio returns was an annualized 3.35% for the 10 year measurement period, and somewhat lower than the 4.64% forward looking assumption referenced in Exhibit 2. The standard deviation of excess returns for the portable alpha portfolio will be reduced by the size of the cash reserve. Generally speaking, the standard deviation generated by the type of portable alpha portfolio presented here will be at a level consistent with a large equity portfolio managed by a diversified group of traditional active managers.

However, the skew and kurtosis values shown for hedge funds in Exhibit 9 are very different than the typical value of zero for traditional managers. Their meaning is much easier to grasp by examining the distribution of returns graphically in Exhibit 10. The graph plots 120 monthly returns for the 10 years ending December 31, 2006.

Exhibit 10: Portable Alpha Hedge Fund Monthly Excess Returns

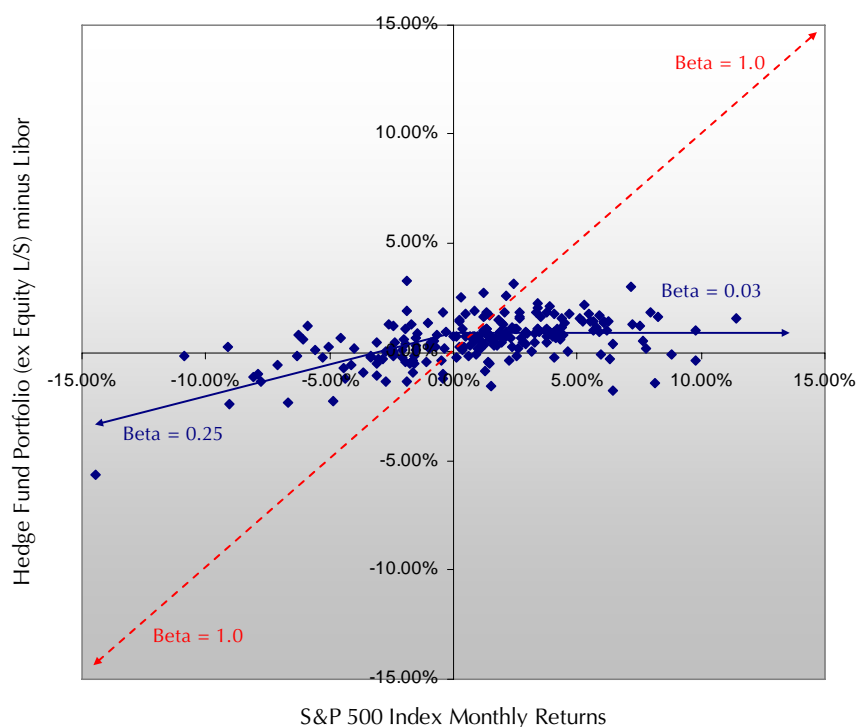


The non-normal characteristics of the portable alpha portfolio are apparent from the graph. The first thing to stick out is the one large negative return (-5.6%) that corresponds to the August 1998 default of the hedge fund Long Term Capital Management, which negatively affected the returns of virtually all hedge funds for that month. But apart for that one occurrence, relative to the normal curve, there are fewer than expected frequency of occurrences near the 0.48% median monthly excess return and a generally flatter distribution than one would expect a normal distribution to look like. The relatively flat distribution caused the high kurtosis measure, while the one large negative return causes the large negative skew. Still, except for the one time event in 1998, most investors would probably overlook the past divergences from the normal curve ideal for the opportunity to earn a median excess return of 0.48% (0.40% average) per month.

A complete picture of risk would combine the beta measures in Exhibit 9 with the non-normal measures in Exhibit 10. In particular is the concern that the hedge funds within the portable alpha portfolio would have a tendency to underperform LIBOR (negative excess return) during months when the S&P 500 Index return is also negative. Exhibit 11 shows that the tendency for hedge fund underperformance and negative stock market returns to simultaneously occur does exist even though the relationship was not found to be statistically significant.

Exhibit 11 plots monthly hedge fund portfolio excess returns (hedge fund portfolio total return minus LIBOR) on the y-axis and monthly S&P 500 Index returns on the x-axis. The time period is expanded beyond ten years to cover the period January 1990 through September 2007. The hedge fund portfolio used in the analysis is the same equal weighted hedge fund portfolio without equity long-short hedge funds that was created in Exhibit 8.

Exhibit 11: Hedge Fund Excess Returns versus S&P 500 Index Return



Ideally, we would want to see no relationship between hedge fund excess returns (over LIBOR) and S&P 500 Index returns, and a beta measurement of zero. The hedge fund portfolio excess returns plotted in Exhibit 11 come reasonable close to the goal of no correlation to the S&P 500 Index return. The monthly hedge fund alphas have very little stock market sensitivity (beta equal to 0.03) when the S&P 500 Index is positive. However, the hedge fund portfolio excess returns do have a modest 0.25 beta when the S&P 500 Index return is negative.⁵ The general downward pressure on hedge fund returns caused by negative stock returns translates into negative excess returns during months when S&P 500 returns fall 3% or more. Fortunately, S&P 500 returns of minus 3% or more in a month have a low probability, but beta sensitivities such as this need to be factored into excess return expectations and, preferably, the hedge fund managers selected for portable alpha portfolios will have beta exposures that are as small as possible.

Portable Alpha Back Test

A useful way to gauge how a portable alpha portfolio might perform and how the swap overlay, cash reserve, and hedge fund components interrelate over time is by way of a back test. The period from January 1, 1990 to December 31, 2006 was selected because the start date corresponds to earliest month that hedge fund index returns are available. We make the following additional assumptions that relate to the management of the portable alpha portfolio:

1. The staggered swap strategy is used to gain the S&P 500 Index return;
2. Only swaps are used (no futures contracts);
3. Swap prices are flat to LIBOR (no basis point premium or discount);
4. The cash reserve is set initially equal to 15% of total invested assets;

5. If the cash reserve grows to more than 18% of total invested assets, reserves in excess of 18% are reallocated at month end to the portfolio of hedge funds;
6. Assets are not withdrawn from hedge funds;
7. Cash reserves are allowed to diminish from S&P 500 swap losses until they are fully depleted, after which we assume that cash from outside the portable alpha portfolio will be used to meet swap outflows, if necessary;
8. Cash reserves earn LIBOR; and
9. The return on the hedge fund portfolio equals the return on the HFRI Conservative Fund of Funds Index, an equal weighting of fund of funds that exhibit lower risk and consistent performance regardless of market movements.

The HFRI Conservative Fund-of-Funds Index was selected for the back test rather than the equal weighting of the nine hedge fund style categories in Exhibit 8 because the Index better represents performance that was achievable over the long back test study period. The HFRI Conservative Fund-of-Funds Index also returned about 3% per year lower so it represents a more cautious presentation of past hedge fund performance.

Exhibit 12: Portable Alpha Performance Back Test, 1990 to 2006

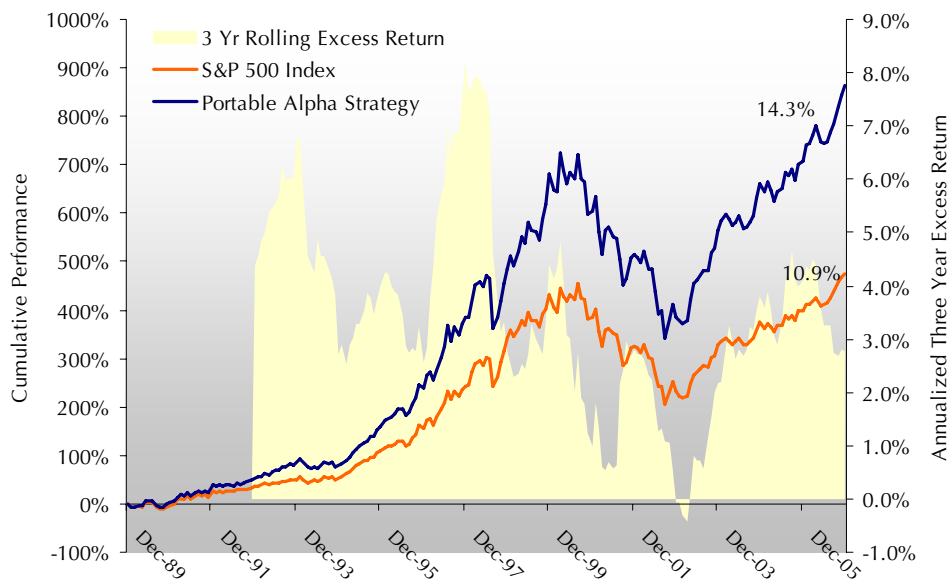


Exhibit 12 shows cumulative performance for the back tested portable alpha portfolio, the S&P 500 Index, and the three year rolling excess return. The portable alpha portfolio returned an annualized 14.26% over the entire 17 year time span while the S&P 500 Index returned 10.89%, a difference of 3.37% per year. The 3.37% is consistent with expected levels of excess return described in Exhibit 2. However, excess return was not consistent, even measured over rolling three year periods. As Exhibit 12 illustrates, three year excess returns were ranging between 3% and 8% until the stock market peak at the end of 1999 and fell consistently until the stock market bottomed in 2002. Three year portable alpha excess returns were in fact slightly negative for a few months at the end of 2002 and beginning of 2003. Since that time excess returns for the portable alpha portfolio rebounded and averaged between 3% and 4% over the last several years.

We see in the performance back test that the market sensitivity of hedge fund returns and portable alpha excess returns is difficult to completely avoid.

Exhibit 12 also illustrates the stock-like volatility in the portable alpha portfolio, reflecting the S&P 500 Index risk that comes from the swap overlay. However, portable alpha investors are likely to be more interested in the level of alpha risk, or tracking error, which equals the standard deviation of excess returns, which equaled 2.69% over the back test period. The information ratio, equal to excess return divided by tracking error, was 1.25 (3.37% divided by 2.69%). The information ratio, like the Sharpe Ratio, is a common measure of the effectiveness of alpha strategies. An information ratio greater than 1.0 would be considered a very attractive investment.

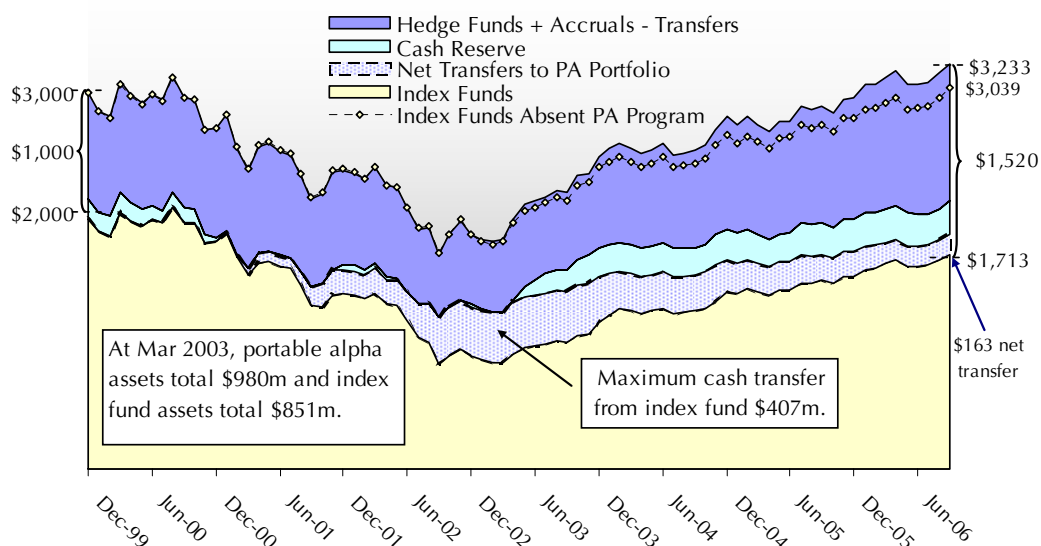
The 2000-2002 Bear Market

Exhibit 6 identified the bear market that began March 31, 2000 as the one market downturn that would have put significant liquidity demands on the portable alpha portfolio that went well beyond the cash reserve. Exhibit 12 showed that it was also a period when the portfolio of hedge funds did not produce excess returns over LIBOR. The trouble that this period would have caused a portable alpha portfolio is examined in Exhibit 13.

In addition to the back test assumptions identified earlier, we assume in Exhibit 13 that the portable alpha portfolio had a value of \$1 billion at January 1, 2000, of which \$150 million was in cash reserves. We further assume that the investor has an additional \$2 billion invested in an S&P 500 index fund. While the amounts might not be the same, it would not be unusual for an investor to have liquid equity assets in addition to the portable alpha portfolio. In this example the investor begins by investing one-third (\$1 billion divided by \$3 billion) of equity assets in a portable alpha portfolio. The purpose for including the index fund assets is to illustrate the impact of a very severe market downturn on cash needs.

Four categories of assets are depicted in the Exhibit. The bottom layer of the graph represents index fund assets. The top three layers represent portable alpha portfolio assets. At January 2000 only two portable alpha layers existed, the top layer representing hedge fund assets and the second layer representing the cash reserve. The cash reserve layer gradually disappears in 2001 and a third layer appears that represents the dollar value of assets transferred out of index fund assets and used to make swap payments. These index fund cash outflows also represent the dollars that would otherwise have been liquidated from hedge funds, but couldn't, and therefore are also hedge fund assets together with the top layer. When the stock market begins its rebound in 2003, S&P 500 swap inflows are first used to replenish the cash reserve. Once the cash reserve again exceeds 18% of portable alpha assets, cash is transferred to the index fund to offset earlier withdrawals.

Exhibit 13: Asset Values during Post Internet Bubble Bear Market and Recovery



The S&P 500 Index fell -39.6% from January 2000 to March 2003, which would have meant that the \$2 billion in S&P 500 index fund assets would have fallen \$792 million to \$1,208 million, a stark reminder of how far the stock market declined. Because the index fund was also being used to support the swap payments of the portable alpha portfolio after depletion of the cash reserve, index fund assets declined further to a low of \$851 million at March 31, 2003 after \$407 million in cash outflows to meet swap payments.⁶ Total portable alpha portfolio assets fall only slightly from \$1 billion at January 1, 2000 to \$980 million at March 31, 2003. The \$150 million cash reserve component of the portable alpha portfolio is fully depleted by that time but positive returns have caused hedge fund assets to grow from \$850 million to \$980 million.

The market recovery begins in April 2003. Cash reserves are fully restored by November 2003 and thereafter swap gains are redistributed to the index fund. From March 30, 2003 to September 30, 2006 a total of \$244 million in cash has been transferred from the portable alpha portfolio to the index fund, leaving only a \$163 million balance of net transfers out index fund assets. Total assets would have grown from \$3 billion at December 31, 1999 to \$3,233 million at September 30, 2006. The dotted line shows that if index funds alone were used during this period, assets would have grown to \$3,039 million.

Our back test demonstrates that a portable alpha portfolio using hedge funds as its source of excess return may require a liquidity backstop beyond a cash reserve to provide for rare but recurring extreme market occurrences like the 2000-2002 bear market. At the same time our results show that liquidity should be manageable during these periods by most portable alpha investors who also allocate to other liquid asset classes.

Summary

Portable alpha has emerged from the failure of traditional active equity management to beat index fund returns. While hedge funds grew in popularity for their high alpha, they were not seen as a replacement for traditional active managers because they focused on absolute or positive returns

and not beating an index. More recently, with the growth and acceptance of index swaps and futures investors now discover that they can use a combination of swaps and hedge funds to accomplish what so many traditional equity firms have been unable to do. These portable alpha strategies have had excellent success thus far but investors need to recognize and manage challenges unique to such a portfolio. They include managing liquidity through a cash reserve, negotiating swap agreements, assessing and limiting counterparty credit risk, and constructing a portfolio of hedge funds that limits, if not eliminates, market risks.

¹ The size of the cash reserve depends upon the expected volatility of the index return being overlaid by the swap. Cliffwater's 17% annual risk forecast for the S&P 500 implies an 8.5% quarterly risk level, so that a 15% cash reserve would be inadequate to cover potential losses only one quarter every twelve years. Even that infrequent occurrence might not require liquidating investments if other portfolio cash flows were added to reserves during the quarter to cover swap losses.

² International Swaps and Derivatives Association (ISDA) Market Survey

³ Hedge funds are sometimes accused of harboring "hidden betas" that would compromise the objective of alpha-beta separation in portable alpha construction. See Asness, Krail, and Liew. (Winter 2001) "Do Hedge Funds Hedge?" in *The Journal of Portfolio Management*.

⁴ Some sponsors include a small proportion of equity long/short managers and compensate for hedge fund beta by reducing the size of the equity swap. For example, and forgetting the cash reserve, if the hedge fund portfolio was thought to have an equity beta of 0.2, the sponsor would reduce the swap size by 20% to achieve a combined beta of 1.0.

⁵ The 0.25 beta is statistically significant with a t-value of 7.51, but differs from the statistically insignificant beta reported in Exhibit 8 for the same hedge fund portfolio because the time periods differ and because the other indexes are omitted as independent variables in Exhibit 11.

⁶ The difference between index fund assets of \$1,208 million and \$851 million does not match the \$407 million in cash outflows because in the scenario where no outflows occur, the index fund experiences greater dollar losses.