Alpha-Beta Recombination: *Can Synthetic Fixed Income Compete with Traditional Long-Only Managers?*

Brian Upbin, Vadim Konstantinovsky, and Bruce Phelps

Brian Upbin
is a director at Barclays Capital Index Products Group in New York, NY.
brian.upbin@barclayscapital.com

Vadim Konstantinovsky
is a director at Barclays Capital Quantitative Portfolio Strategies Group in New York, NY.
vadim.konstantinovsky@barclayscapital.com

Bruce Phelps
is a managing director at Barclays Capital Quantitative Portfolio Strategies Group in New York, NY.
bruce.phelps@barclayscapital.com

Alpha-beta separation is an investment strategy that uses derivatives and very little cash to synthetically replicate a desired benchmark (beta exposure) and deploys the available cash in an alpha source independent of the beta. The synthetic beta and alpha are then *recombined* into a "synthetic portfolio" that competes for mandates with traditional long-only portfolios.

Investors are receptive to fixed-income (FI) recombination strategies for two reasons. First is the relatively low active returns (i.e., portfolio total return less benchmark return) of traditional long-only FI. Given the typical constraints of long-only FI mandates and the low volatility of the cash FI markets, the potential for alpha is limited even in the presence of manager skill. New pension regulations and the desire for more stability in a plan's funding status are leading to increased allocations to FI. But as FI becomes a larger part of the overall portfolio, low active returns of traditional managers become less acceptable. The appeal of alpha-beta separation is that the investor gets a desired (and often mandatory) FI beta exposure, but obtains an alpha from a more promising source, such as hedge funds that operate with fewer constraints and can apply their skill to more volatile assets.

A second reason for the attention to alpha-beta recombination is the availability of new liquid derivatives that make synthetic beta replication, and hence, recombination, easier and cheaper.

Despite the logical appeal of alpha-beta recombination, there has been little analysis of synthetic FI performance. How well does alpha-beta recombination work? Are synthetic FI portfolios really fixed-income portfolios; that is, do they have risks similar to those of traditional FI portfolios, but just produce higher alpha? Or is their risk profile so different as to render them unsuitable for FI allocations? After all, investors allocate assets to FI in order to add tracking error or funding status stability to their overall portfolios. Are some alpha sources better than others for the purpose of constructing synthetic FI portfolios? Finally, can any unanticipated interactions between the alpha source and the synthetic beta make a synthetic FI portfolio strategy unattractive?

Compared with traditional long-only FI investing, alpha-beta recombination involves a number of new issues, including the following:

- Alpha investments may contain undesired systematic exposures, such as U.S. large-cap equity, that need to be hedged out. Hedges will require periodic re-estimation of exposures and appropriate adjustments, which may affect the magnitude and volatility of the alpha source, so that the adjusted alpha may be lower.

- Synthetic (cashless) beta involves counterparty risk and the need to periodically rebalance and roll derivatives positions, as well as funding and mark-to-market risks. What is the tracking error (TE) and tracking error volatility (TEV) of the synthetic beta vis-à-vis the underlying cash benchmark? Is the beta TE correlated with the alpha source?
- Plan sponsors typically invest with more than one FI manager in order to diversify their managers' idiosyncratic risk. If such risk is significant in the synthetic universe, the sponsor may need a strategy to lower it to the level of traditional FI.

We investigated the performance of synthetic FI portfolios benchmarked against the Barclays Capital[1] U.S. Aggregate Index (Aggregate). First, we identified several potential alpha sources, namely, hedge funds from a range of established investment styles, with relatively low expected common systematic exposures. Each fund was examined for several major beta exposures, and if such exposures were present, we hedged them, producing adjusted hedge fund returns. Next, we synthetically replicated the Aggregate Index with liquid derivatives. Finally, we combined adjusted hedge fund returns with the synthetic Aggregate beta to form synthetic FI portfolios in order to address the questions posed earlier: Can alpha-beta recombination compete with traditional FI? Are these synthetic portfolios veritable FI, but with a higher alpha? Or, do they bring additional risks not present in traditional FI?

ALPHA SOURCES FOR SYNTHETIC FIXED-INCOME PORTFOLIOS

Ideally, alpha should be uncorrelated not only with the Aggregate Index, but with other systematic exposures that a sponsor would normally have in its asset allocation strategy. We attempted to eliminate five such exposures: U.S. large-cap equity (SPX), U.S. small-cap equity (Russell 2000), U.S. fixed income (10-year UST), foreign exchange (USDX), and commodities (SPGSCI). Although hedge fund returns may contain other systematic exposures (e.g., short volatility), we limited our investigation to these five, because investors typically have allocations to at least one of them and because they can be hedged with liquid derivatives. Other beta exposures are more difficult to hedge. Also, for return and diversification purposes, some sponsors may purposefully seek these other exposures as "alternative" betas in their overall portfolios.

We limited our alpha source selection to hedge fund styles that are likely to have low or easily hedgeable beta exposures. We obtained hedge fund returns and (unlevered) assets under management (AUM) from the Hedgefund.net (HFN) database (including fund of funds). All returns in the database are self-reported by individual funds and are net of fees. Each fund is self-classified by investment style, market, and geographic region. The five styles we selected are Global Macro (Macro), Market Neutral (MktNeut), Broad Relative Value (RelVal), Multi-Style (MultiStyle), and Fund of Funds (FoF).

For each of the five styles, we generated a set of funds using screens for AUM, length-of-return time series, and Barclays Capital/HFN Hedge Fund Index eligibility. Exhibit 1 summarizes our samples of funds generated by applying these filters to each of the five styles.

Exhibit 2 details the monthly returns for all five styles from January 2000 to March 2008. The top half presents unadjusted (before hedging) returns of the average fund.[2] Macro had the highest average monthly return of 114 basis points (bps), and the highest volatility (standard deviation of 210 bps). MktNeut, FoF, and MultiStyle had lower returns (45 bps, 69 bps, and 83 bps, respectively), but were much less volatile (standard deviations of 118 bps, 113 bps, and 126 bps, respectively). RelVal had a comparable average return (66 bps), but was much less volatile (standard deviation of 79 bps) than all other styles.

In order to remove the undesired systematic exposures, we first measured and then hedged significant exposures using liquid futures (S&P 500, Russell 2000, 10-year Treasury, USDX, and SPGSCI index returns).

For each of the five systematic factors, we created a time series of returns using futures prices where each contract is rolled from the nearby to the next at the beginning of the expiration month of the nearby contract. For each fund, we regress its trailing two years of monthly returns (R_t) against the five (k) factor returns, f_k, to arrive at estimated hedge ratios (β_k), or factor loadings, for the upcoming month,

$$R_t = \alpha_t + \sum_k \beta_{k,t} \times f_{k,t} + \varepsilon_t \qquad (1)$$

We then check which hedge ratios are statistically significant at a 5% level. If significant, the monthly return of the fund is adjusted in the next month to subtract that

EXHIBIT 1

Summary of Hedge Fund Samples Selected for Synthetic Fixed-Income Portfolios

January 1998–March 2008	Macro	Market Neutral	Multi-Style	Broad Relative Value	Fund of Funds
Total Number of Funds	**56**	**33**	**62**	**70**	**182**
Funds by Market					
Equity Funds	8	31	9	5	n/a
Fixed-Income Funds	6		7	34	n/a
Multi-Market Funds	39	2	41	8	n/a
Other Markets (Convertibles, FX, Commodities)	3		5	23	n/a
January 2000–March 2008					
Length-of-Return Series					
Avg. Length (in Months) of Hedge Fund Return Series	90	82	98	86	100
Avg. Length (in Months) of Adjusted Hedge Fund Return Series	66	58	74	62	76
Monthly Sample Size					
Avg. Sample of Funds with 2 Years of Historical Returns	38	19	47	44	140
Largest Sample of Funds with 2 Years of Historical Returns	52	32	61	63	181
Smallest Sample of Funds with 2 Years of Historical Returns	19	5	27	19	75

EXHIBIT 2

Monthly Hedge Fund Returns of the Average Fund: Unadjusted and Adjusted Returns (% per month), January 2000–March 2008

Unadjusted HF Returns	Avg.	Std. Dev.	Skew	Kurt.	Min	4th Qtr	3rd Qtr	2nd Qtr	Max	Corr. w/ U.S. Agg.	Corr. w/ S&P 500	Corr. w/ Russell 2000	Auto-Corr. Lag1
Macro	1.14	2.10	1.04	3.84	–3.27	–0.07	1.09	2.14	10.91	0.10	0.49	0.38	–0.05
MktNeut	0.45	1.18	–0.08	3.22	–3.64	–0.06	0.61	1.09	4.66	–0.03	0.62	0.54	0.00
MultiStyle	0.83	1.26	–0.83	1.03	–3.35	0.24	0.95	1.56	3.14	–0.05	0.54	0.57	0.17
FoF	0.69	1.13	–0.28	1.16	–2.50	0.09	0.76	1.51	4.24	0.02	0.43	0.43	0.11
RelVal	0.66	0.79	–1.85	8.56	–3.67	0.36	0.74	1.09	2.32	0.12	0.14	0.17	0.29
Adjusted HF Returns	Avg	Std. Dev.	Skew	Kurt.	Min	4th Qtr	3rd Qtr	2nd Qtr	Max	Corr. w/ U.S. Agg.	Corr. w/ S&P 500	Corr. w/ Russell 2000	Auto-Corr. Lag1
Macro	0.94	1.87	1.00	3.98	–3.58	0.02	0.86	1.72	9.60	0.07	0.45	0.32	0.01
MktNeut	0.49	0.95	–0.21	2.90	–2.84	0.06	0.53	1.05	3.59	0.06	0.27	0.30	0.02
MultiStyle	0.72	1.09	–0.68	0.75	–2.85	0.16	0.84	1.41	2.88	–0.12	0.54	0.56	0.15
FoF	0.63	0.98	–0.19	1.09	–2.00	0.09	0.70	1.31	3.93	0.03	0.39	0.37	0.16
RelVal	0.63	0.75	–1.65	9.18	–3.55	0.30	0.68	1.01	2.51	0.14	0.13	0.14	0.26

exposure (positive or negative). This adjusted return is then scaled by the amount of margin an investor must post to execute this futures hedge. We assume that 5% of the total hedge fund investment is held in a cash margin account earning a risk-free return, while the remaining 95% is invested in the alpha source. This process was repeated for every month from January 2000 through March 2008.

Exhibit 3 summarizes the number and magnitude of significant factor loadings by hedge fund style as well as the average adjusted R^2 across managers of a given style. Macro and FoF had the highest average number of statistically significant factor loadings per fund. The five factors explain 27% and 34%, respectively, of their returns. Not surprisingly, RelVal had the highest percentage of funds with no significant loadings (55%, an average

EXHIBIT 3
Significant Loadings on Systematic Exposures, January 2000–March 2008

Hedge Fund Category	Avg. # Funds per Month	% of Funds with Significant Loadings (by exposure)					% of Funds with Significant Loadings (by number of loadings)						Adjusted R^2 of Monthly Rolling Regressions	
		SPX	Russell 2000	10-yr UST	SPGSCI	USDX	0 Loadings	1 Loadings	2 Loadings	3 Loadings	4 Loadings	Avg. Loadings per Fund	Avg. R^2 of Each Fund	R^2 of Avg. Mgr.
Macro	38	37%	0%	14%	15%	16%	40%	40%	17%	2%	0%	1.08	27%	57%
MktNeut	19	41%	0%	11%	15%	10%	41%	43%	12%	3%	0%	0.97	22%	47%
MultiStyle	47	27%	0%	13%	14%	15%	51%	32%	13%	3%	0%	0.93	27%	64%
FoF	140	34%	0%	12%	18%	12%	47%	34%	14%	3%	0%	1.10	34%	52%
RelVal	44	24%	0%	15%	7%	13%	55%	33%	10%	2%	0%	0.71	7%	15%

adjusted R^2 across managers of just 7%), while Macro had the highest percentage of funds with two or more significant loadings (19%).

Exhibit 3 also reports the R^2 for the average return of all funds within a style. For this "average" manager, much of the idiosyncratic risk is diversified away, so that the R^2 for the average fund is considerably higher than the average R^2 across managers. This result hints at the possibility of approaching the average hedge fund manager's performance via hedge fund replication. Although not shown, these systematic exposures vary over time, implying that a synthetic FI investor needs to monitor the systematic exposures of his alpha source.

Using the estimated regression coefficients as hedge ratios, we constructed adjusted hedge fund returns which we "ported" to the synthetic FI beta. As shown in Exhibit 2, there is only a modest reduction in the average adjusted return for each style compared to the style's average unadjusted return, which justifies the use of adjusted returns in the alpha-beta recombination.

Across all five styles, adjusted returns exhibited lower volatility than the corresponding unadjusted returns. This is a desirable result for synthetic FI investors because it makes the synthetic FI portfolio's volatility profile more similar to traditional FI. Removing the systematic exposures also tends to reduce the range of returns, which is also desirable. Exhibit 2 also shows that adjusted returns have low correlation with the Aggregate Index. Correlation, however, is only a linear measure of codependence; tail dependency between fund returns and Aggregate returns must be checked for.

To identify tail dependency, Exhibit 4 plots the monthly adjusted returns for Macro (Panel A) and Mkt-Neut (Panel B) against Aggregate Index returns.[3] Panel A of Exhibit 4 shows some tail dependency, but Panel B shows no tail dependency. Tail dependency is not observed for the other three styles. As we will show later in the article, there is also little to no tail dependency between traditional FI active returns and the Aggregate.

Adjusted and unadjusted returns exhibit relatively low first-order autocorrelation. The degree of autocorrelation in adjusted returns may reflect strategies for which performance persists over time. Alternatively, the autocorrelation may reflect return smoothing, which would question funds' reported volatility. If so, return volatility of traditional FI managers, who are less able to smooth returns, may compare unfavorably (and unfairly) to that of synthetic FI managers. (In fact, as shown in Exhibit 12, traditional FI active returns tend to exhibit very low first-order serial correlation.)

Strictly speaking, adjusted returns are not active returns because we have not specified a benchmark. As we will explain later, the investor gets synthetic beta via a cashless swap in exchange for paying LIBOR plus a spread. Because the opportunity cost for obtaining the synthetic beta is LIBOR + spread, this value is a natural benchmark for the alpha source. Consequently, we define the active adjusted return for the alpha source as its adjusted return less the monthly LIBOR + spread. We port this active adjusted return onto the synthetic beta return.

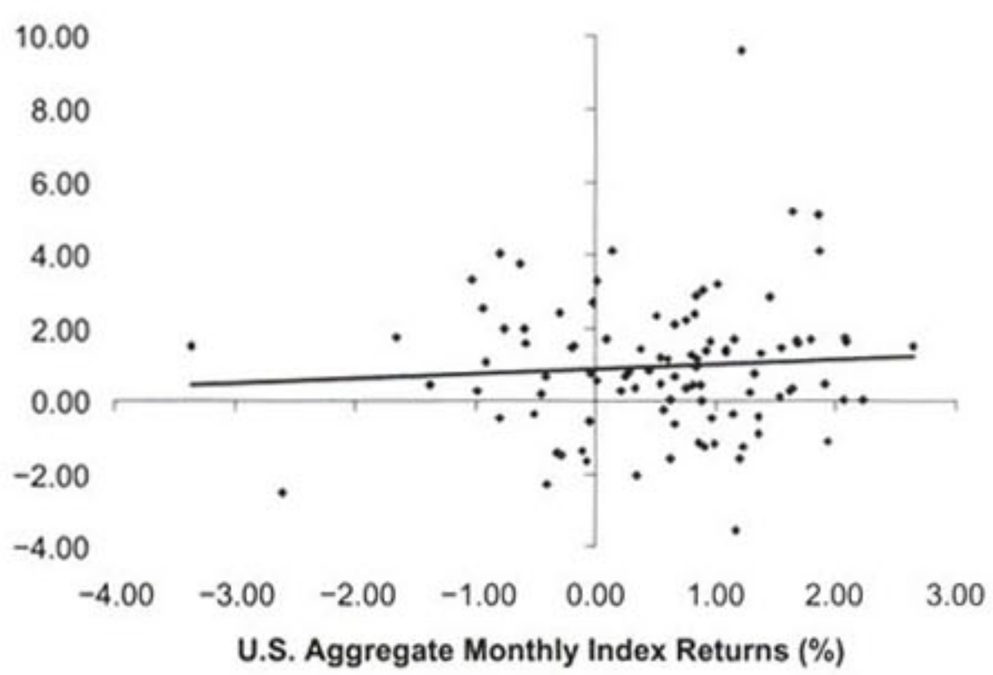
BETA SOURCES FOR SYNTHETIC FIXED-INCOME PORTFOLIOS

The next stage in the construction of synthetic FI portfolios is to obtain the desired FI exposure (e.g., the Aggregate Index). Total return swaps that guarantee the

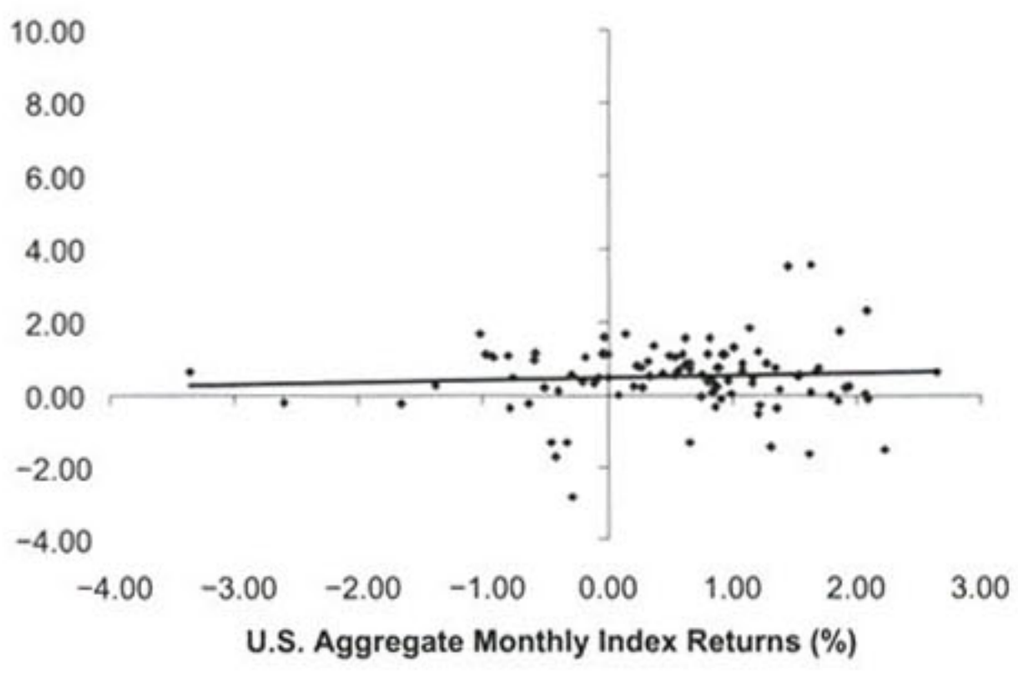
EXHIBIT 4

Average Manager Adjusted Returns vs. Aggregate Index Returns, January 2000–March 2008

Panel A: Macro



Panel B: MktNeut



Note: All trend lines used in this and subsequent plots are linear least squares regression fits.

Aggregate's return are relatively illiquid and expensive. In response, investors typically use derivatives to replicate the Aggregate. Investors either assemble a basket of liquid derivatives—properly weighted to closely track the Aggregate and rebalanced monthly—on their own or enter into a total return swap on such a basket managed by a broker/dealer. Barclays Capital, for example, offers such a swap, called a Replicating Bond Index (RBI®) basket swap. Investors receive the total return on the RBI basket, which, in principle, should closely match the Aggregate's return. While some tracking error is inherent in an RBI swap, such swaps are very liquid and inexpensive.

Our alpha-beta recombination strategy receives the total return on an RBI basket replicating the Aggregate and pays one-month LIBOR plus a spread. The basket is established at the beginning of each month and is not rebalanced until month-end. RBI swaps come in a variety of flavors depending on the set of derivative instruments. For this study we used an RBI basket containing total return swaps (TRS) on the UST and MBS components of the Aggregate Index (currently 61% of the Aggregate's total market value) and a blend of six funded par interest rate swaps for each of the other components (i.e., agency, credit, CMBS, and ABS). The swaps are weighted so as to match each component's key-rate duration profile.

Exhibit 5 shows that from January 2000 to March 2008, the RBI swap's average monthly return and standard deviation were similar to those of the Aggregate Index. Correlation of monthly returns between the RBI and the Aggregate was 0.94. The average monthly TE (i.e., the average of the monthly differences between RBI and Aggregate returns) was 2.6 bps with a volatility of 22.3 bps per month. RBI swap returns had a similar negative skew and positive kurtosis as those of Aggregate returns.

Exhibit 6 plots the time series of monthly TE for the RBI and reveals a sharp increase in the magnitude of RBI TEs in the second half of 2007 and the first quarter of 2008, reflecting dramatic interest rate and spread movements. Exhibit 6 also shows that large TEs are not an isolated occurrence and were also observed over the period 2001–2003. Because RBI TEs have, at times, exceeded the monthly average return on the Aggregate Index, this raises the issue of how RBI TEs interact with both the Aggregate Index and funds' active adjusted returns. Compared to the Aggregate Index, the RBI swap is underweight exposures to spreads-to-swaps. As a result, the sharp spread-widening since the second half of 2007 has produced large positive RBI TEs. Assuming that spread markets recover, we expect the RBI swap to underperform the Aggregate.

Exhibit 5 shows that RBI TEs are positively correlated with the returns of the Aggregate Index. Why? The RBI swap has an underweight to spreads-to-swaps. In normal market conditions, swap spreads and spreads-to-swaps tend to be negatively correlated with changes in

EXHIBIT 5

RBI Basket Swap: Total and Relative Returns, January 2000–March 2008

	Monthly Total Returns (% per month)								Performance vs. Aggregate Index (bps)					
	Avg.	Std. Dev.	Skew	Kurt.	Min	Max	Corr. w/U.S. Agg.	Auto-Corr. Lag1	Avg. TE	Avg. TEV	Kurt.	Min TE	Max TE	Corr. of TE w/Agg.
RBI	0.56	1.13	−0.76	1.38	−3.67	2.68	0.94	0.11	2.6	22.3	4.52	−59.8	88.6	0.41
U.S. Aggregate Index	0.53	1.02	−0.86	1.65	−3.36	2.65	1.00	0.04						

EXHIBIT 6

RBI Tracking Error vs. Aggregate Index, January 2000–March 2008

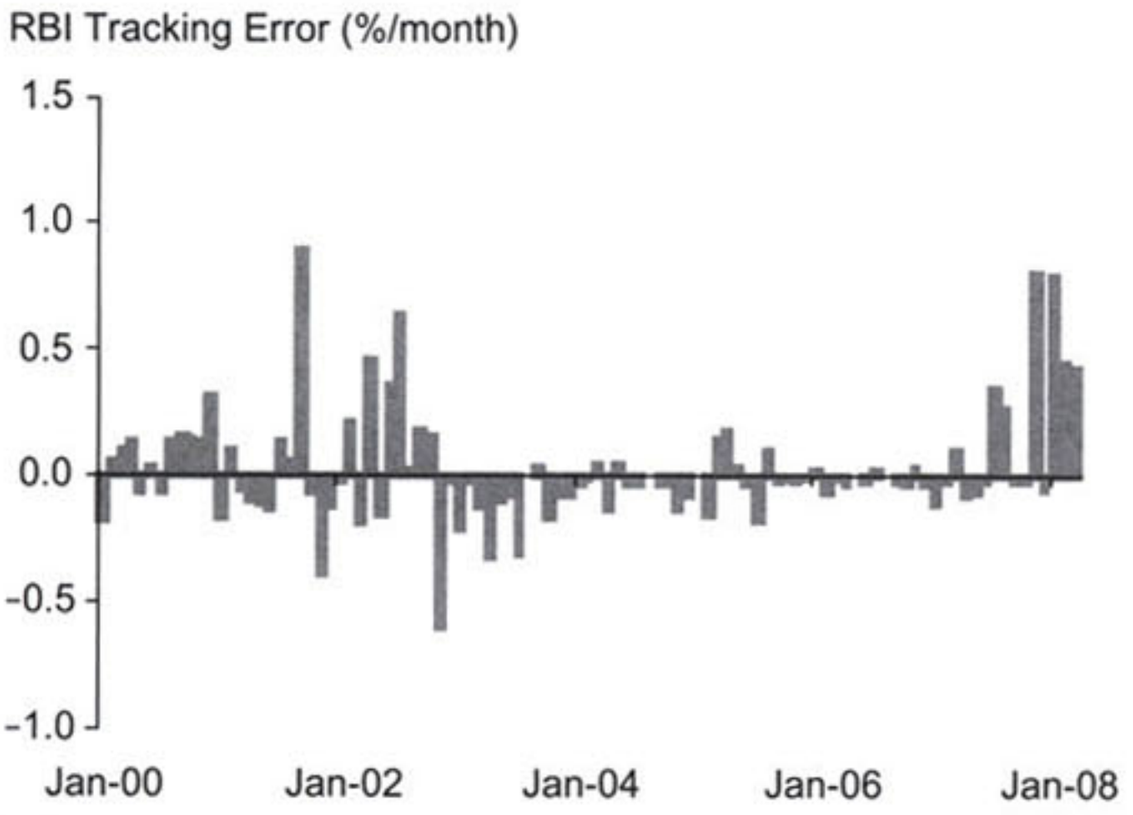
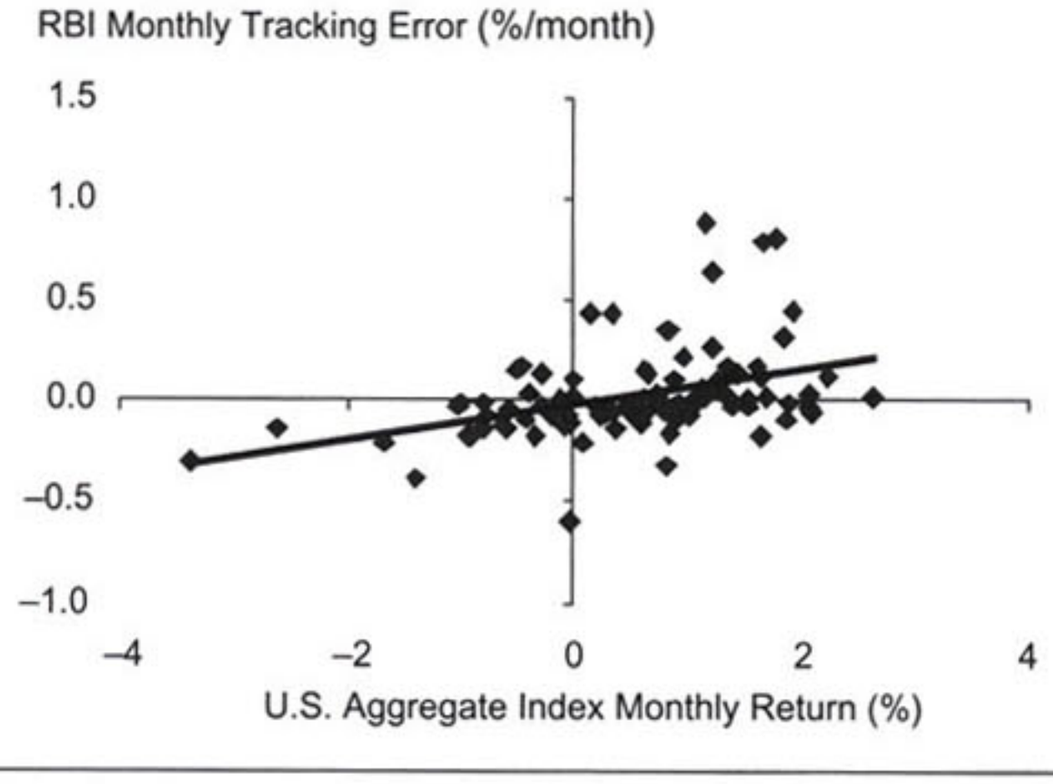


EXHIBIT 7

RBI Tracking Error vs. Aggregate Index Returns, January 2000–March 2008



interest rates. When rates rise, spreads-to-swaps tighten, and vice versa. Because interest rates are the prime factor in the Aggregate's total return performance, we would expect that in a rally (when the Aggregate return is positive) swap spreads and spreads-to-swaps would widen and the RBI would outperform the Aggregate, producing positive correlation. Conversely, when rates rise and spreads-to-swaps narrow, the RBI should underperform the Aggregate.

We also checked for tail dependency between the RBI and the Aggregate. Exhibit 7 plots monthly TEs for the RBI swap from January 2000 to March 2008. There is a tendency for the two series to be positively correlated, as well as some evidence of tail dependency with large positive Aggregate returns accompanied by large positive RBI TEs. Although there is no apparent dependency in the negative tail, the positive tail dependency does suggest its possibility.

ALPHA-BETA RECOMBINATION: SYNTHETIC FIXED-INCOME PORTFOLIOS

Now, alpha and beta can be recombined to create synthetic FI portfolios. We assume that a synthetic FI portfolio obtains beta exposure via an RBI receiver swap (i.e., receiving the total return on the Aggregate RBI basket while paying one-month LIBOR + 15 bps. The annual rate of 15 bps represents an assumed market offer spread).

Structural Details of Recombining Alpha and Beta

We assume a direct investment in a portable-alpha fund (Alpha Fund).[4] The Alpha Fund purchases shares of hedge funds and executes the RBI swap. We also assume that the RBI swap requires net payments on a monthly basis.

- *Rebalancing of notional swap amounts.* The notional of the synthetic beta exposure must be adjusted each month to reflect the alpha and beta returns. This feature is reflected in the RBI pricing spread. If the notional of the swap were not changed, the cumulative total return in dollar terms of the synthetic strategy would not track a traditional FI portfolio which automatically reinvests any gains or losses.
- *Funding of negative net monthly RBI returns.* If the beta return in a month is less than the LIBOR pay leg, i.e., (LIBOR + 15)/12, the Alpha Fund must make a net payment to the broker/dealer by redeeming some hedge fund shares.
- *Meeting collateral requirements.* An RBI swap may require the Alpha Fund to post fund shares as collateral.

Exhibit 8 summarizes the structure of the alpha-beta recombination strategy.

Synthetic Fixed-Income Portfolio Returns

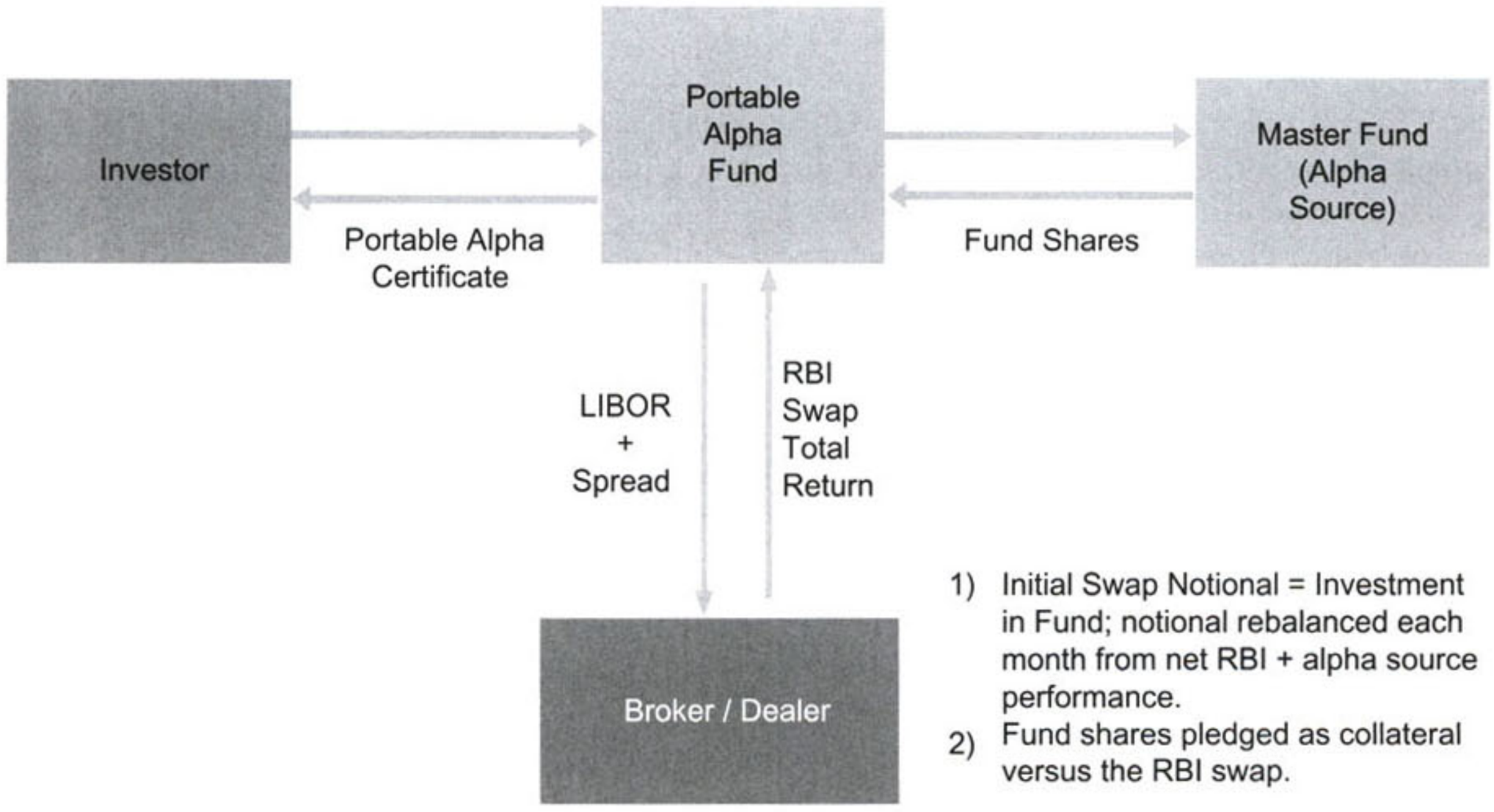
We define the total and active synthetic FI portfolio returns as follows:

$$\begin{aligned}\text{Syn Monthly TR} &= [\text{Adj Monthly TR} \\ &\quad - (1\text{-moL} + 15)/12] \\ &\quad + [\text{RBI Monthly TR}] \\ &= [\text{active return of alpha source}] \\ &\quad + [\text{RBI return}] \end{aligned} \tag{2}$$

$$\begin{aligned}\text{Syn Active Monthly TR} &= \text{Syn FI Monthly TR} \\ &\quad - \text{Aggregate Monthly TR} \\ &= [\text{Adj Monthly TR} \\ &\quad - (1\text{-moL} + 15)/12] \\ &\quad + [\text{RBI TR} \\ &\quad - \text{Aggregate Monthly TR}] \\ &= [\text{active return of alpha source}] \\ &\quad + [\text{RBI tracking error}] \end{aligned} \tag{3}$$

As Equation (2) shows, a synthetic FI portfolio's total return and volatility are affected not only by the active adjusted return of its alpha source, but also by the

EXHIBIT 8
Typical Alpha-Beta Recombination Structure



RBI returns and the correlation of the active returns with the RBI.

Total return volatility. For each of the five fund styles, Exhibit 9 presents monthly average adjusted fund returns; active adjusted returns (i.e., adjusted return minus (1-mo LIBOR + 15)/12); synthetic FI returns (using RBI); and synthetic FI active returns (synthetic FI total return minus U.S. Aggregate return). For comparison, Exhibit 10 shows monthly total return statistics for the Aggregate and four sources of fund beta exposures. Monthly average returns are equal-weighted averages of all funds in a given month. (Note that the synthetic FI return for the Macro fund style with an RBI synthetic beta is labelled Macro +RBI, and so forth.)

For the period January 2000–March 2008, synthetic FI portfolios consisting of the average hedge fund manager of a given style produced average monthly total returns ranging from 73 bps for MktNeut +RBI to 119 bps for Macro +RBI. Although a couple of basis points are due to the outperformance of the synthetic beta over the period, the bulk comes from the hedge funds outperforming LIBOR + spread. Synthetic FI returns exceed the average monthly return of 53 bps per month for the Aggregate. Their volatility, however, is higher (see Column (b) in Exhibit 9), ranging from 137 bps per month (RelVal +RBI) to 218 bps per month (Macro +RBI), compared to 102 bps per month for the Aggregate. So, while the synthetic FI portfolios (except

EXHIBIT 9

Average Monthly Adjusted Fund Returns, Active Fund Returns, Synthetic Fixed-Income Total Returns, and Active Returns across All Funds in Sample (Average Manager), January 2000–March 2008

	Monthly Adj. Fund Returns		Monthly Active Adj. Fund Returns				Monthly Synthetic Fixed-Income Total Returns							Monthly Synthetic Fixed-Income Active Returns				
	Avg.	Std. Dev. (a)	Avg.	Std. Dev.	Corr. w/ RBI	Corr. w/ RBI TE	Avg.	Std. Dev. (b)	Skew	Kurt.	Min	Max	Auto-Corr Lag1	Avg.	Std. Dev. (TEV) (c)	Min	Max	Ann.IR
Macro + RBI	0.94	1.87	0.63	1.86	0.01	−0.24	1.19	2.18	0.64	3.01	−5.39	10.37	0.01	0.66	1.82	−3.00	9.16	1.25
MktNeut + RBI	0.49	0.95	0.18	0.95	−0.01	−0.22	0.73	1.47	−0.44	1.25	−3.52	4.56	0.04	0.20	0.93	−3.23	3.11	0.75
MultiStyle + RBI	0.72	1.09	0.41	1.09	−0.22	−0.53	0.97	1.39	−0.34	0.78	−3.15	4.43	0.12	0.44	0.99	−3.03	2.35	1.53
FoF + RBI	0.63	0.98	0.32	0.97	−0.06	−0.24	0.88	1.45	−0.45	1.04	−3.60	4.70	0.07	0.35	0.92	−2.29	3.49	1.32
RelVal + RBI	0.63	0.75	0.32	0.73	0.04	−0.32	0.88	1.37	−0.45	0.63	−3.48	3.53	0.13	0.34	0.69	−3.39	2.11	1.71

Note: Active Adjusted Return = Adjusted Monthly Return − (1-mo LIBOR + 15)/12 = Active return of the alpha source.

Source: Barclays Capital calculations, HedgeFund.net.

EXHIBIT 10

Total Return Statistics of U.S. Aggregate Index and Beta Exposures, January 2000–March 2008

	Monthly Total Returns						
	Avg.	Std. Dev (a)	Skew	Kurtosis	Min	Max	Auto-Corr. Lag1
U.S. Aggregate	0.53	1.02	–0.86	1.65	–3.36	2.65	0.04
S&P 500	0.05	3.95	–0.27	0.43	–11.00	9.67	0.03
Russell 2000	0.57	5.54	–0.10	0.16	–15.18	16.42	0.07
SPGSCI	1.30	6.30	–0.05	–0.37	–14.41	15.41	–0.01
USDX	–0.33	2.14	–0.05	–0.14	–5.35	4.79	0.14

Source: Barclays Capital.

Macro+RBI) have volatility 30% to 40% higher than the Aggregate, their monthly average returns are also higher, ranging from 20 to 44 bps per month.

And although the synthetic FI portfolios are more volatile than the Aggregate, their volatilities are considerably closer to that of the Aggregate than to any other asset class (e.g., S&P 500, see Exhibit 10). The exception is Macro+RBI whose volatility (218 bps per month) is slightly greater than the USDX (214 bps per month). Its volatility, however, is noticeably closer to the Aggregate (102 bps per month) than to the volatility of the S&P 500 (395 bps month).

Synthetic fixed-income portfolio tracking errors. Exhibit 9, Column (c), shows that synthetic FI portfolio monthly TEVs (versus the Aggregate) range from 92 bps (FoF+RBI) to 182 bps (Macro+RBI). These TEVs are generally the same magnitude as the monthly volatility of the Aggregate Index (102 bps) and not much less than the volatility of the fund itself. From the definition of synthetic FI active returns in Equation (3), the TEV is a function of the volatility of the active fund return, the volatility of the RBI TEs, and their correlation. The volatility of the active fund strategy dominates. For example, the monthly volatility of active adjusted Macro returns is 186 bps compared with 22 bps for RBI TEs. It would require considerable negative correlation between active fund returns and RBI TEs to produce synthetic FI TEV much below the fund volatility.

Skew, kurtosis, and tail behavior. Exhibit 9 presents other details of the distribution of synthetic FI total returns using the "average" manager of each style. Four of the five styles (except Macro) exhibit negative skew (ranging from –0.34 to –0.45) suggesting that returns are asymmetrical, with large negative returns more likely than large positive returns. However, all synthetic FI returns exhibit less negative skew than the Aggregate Index (–0.86). In addition, the skewness of the synthetic FI returns is generally more negative than the corresponding funds' skewness due to the addition of the RBI return, which also exhibits a negative skew (–0.76). The presence of negative skew in Aggregate and RBI returns is driven largely by credit and swap exposure as their returns are limited to the upside, but have much larger downside risk. However, some synthetic styles, MultiStyle+RBI and RelVal+RBI, have less negative skewness than their own adjusted fund returns, suggesting some helpful interactions with RBI returns that reduce occurrences of large negative returns.

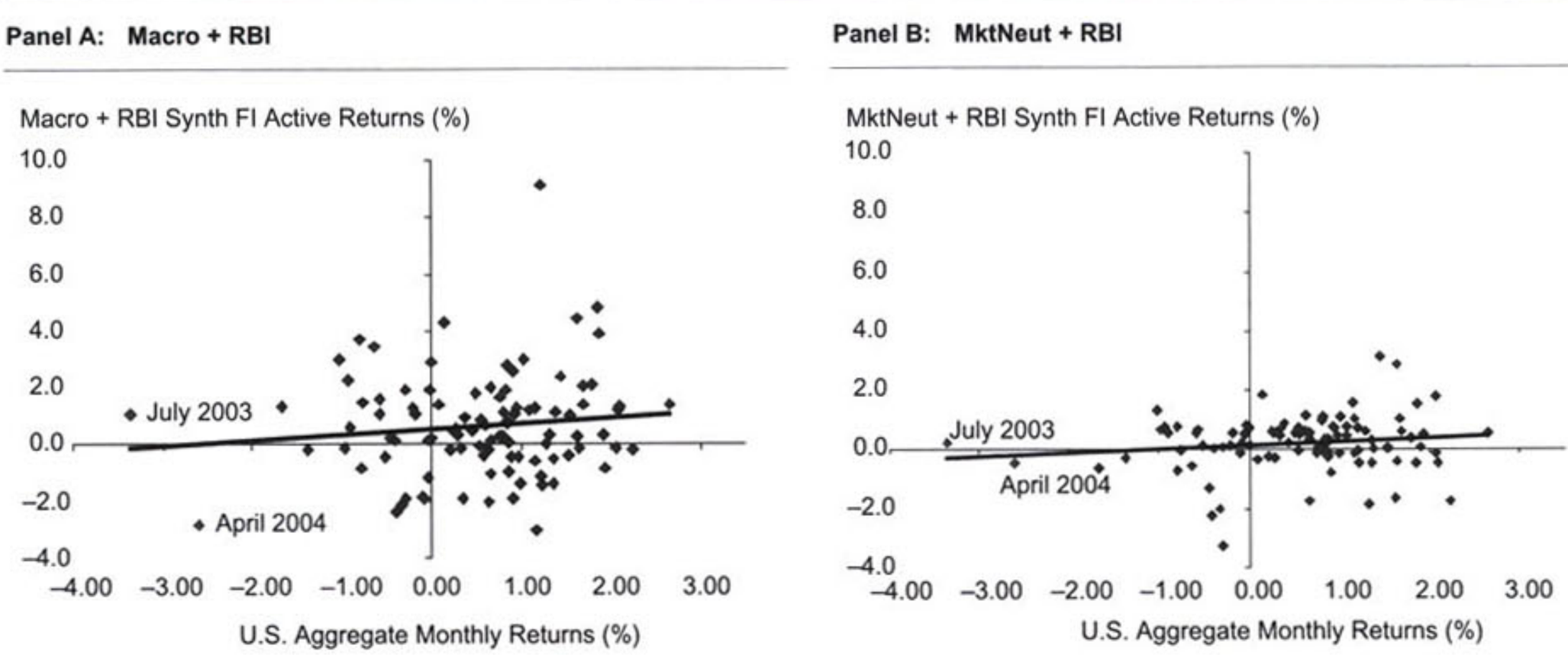
All five synthetic FI portfolios exhibit positive (excess) kurtosis (ranging from 0.63 to 3.01), indicating the presence of *fat tails* in their distribution of returns. Fat tails are common, especially in credit, option, and leverage strategies with their potential for large absolute value returns. However, except for Macro+RBI, the kurtosis for synthetic FI is less than the positive kurtosis of the Aggregate (1.65 as shown in Exhibit 5). This is a bit odd, as some of the adjusted fund returns exhibit positive kurtosis much larger than the Aggregate. This suggests that some large fund returns occur simultaneously with Aggregate returns that are small or of the opposite sign, and vice versa. This helps dampen extreme returns for the synthetic FI portfolio. We see some evidence for this in the synthetic FI portfolios' extreme minimum returns (except Macro+RBI), which are only moderately larger than the minimum returns for the funds themselves and are close to those for the Aggregate. This means that large negative fund returns have not coincided with large negative Aggregate returns. Maximum synthetic returns are, however, considerably greater than the Aggregate returns and the adjusted fund returns, suggesting the potential for interaction effects to exacerbate (so far, positive) tail behavior.

For example, although Exhibit 9 shows that Macro fund returns tend to have low correlation with the Aggregate returns, Panel A of Exhibit 11 shows that a single large negative synthetic Macro+RBI active return coincides with a large negative Aggregate return, as well as numerous large positive returns occurring simultaneously.[5] These synthetic FI tail events also reflect the compounding effect of large RBI TEs that tend to occur together with large Aggregate returns of the same sign. However, Exhibit 11, Panel A, also shows that large active and Aggregate returns often occur simultaneously with opposite signs. Nevertheless, despite the low correlation between Macro fund returns and Aggregate returns, Macro+RBI synthetic FI total returns exhibit some fat-tail behavior and the potential for large extreme returns.

MktNeut +RBI and RelVal +RBI also exhibited much lower kurtosis than their adjusted funds' returns. As shown in Panel B of Exhibit 11, there were several occurrences of large positive returns for both MktNeut +RBI active returns and Aggregate returns with no occurrences of large simultaneous negative returns. Exhibit 11, Panel B, also shows that large active and Aggregate returns often occurred simultaneously with opposite signs. Nevertheless, while the synthetic FI port-

EXHIBIT 11

Alpha-Beta Interaction: Tail Behavior of Monthly Synthetic Fixed-Income Active Returns vs. Aggregate Index Returns, January 2000–March 2008



folio kurtosis is less than the fund's kurtosis, the minimum and maximum extreme values increased, suggesting the potential for unfavorable alpha-beta interactions to remain a risk of the synthetic FI strategy.

COMPARISON OF SYNTHETIC AND TRADITIONAL FIXED-INCOME PORTFOLIOS

We use the self-reported performance data for traditional (long-only) institutional Core and Core+ FI managers from the *eVestment Alliance* database.[6] Both the Core and Core+ categories are self-described. Core managers' benchmark is the U.S. Aggregate. Typically, Core managers are restricted from using noncash and out-of-benchmark investments.[7] Most Core+ managers in the sample also use the U.S. Aggregate as a benchmark, although some may use the U.S. Universal Index. Core+ managers are allowed to hold out-of-benchmark assets (e.g., high-yield, nondollar, and emerging markets) and to use derivatives (futures and structured credit investments).[8]

Total Returns

Exhibit 12 shows that from January 2000 to March 2008, traditional FI Core funds generated an average after-fee total return (assuming a monthly fee of 1 basis point) of 53 bps per month, equal to the average monthly return

EXHIBIT 12

Average Core and Core+ Fixed-Income Total and Active Returns (% per month), January 2000–March 2008

	Total Returns							Active Returns							
	Avg.	Std. Dev.	Skew	Kurt.	Min	Max	Auto-Corr. Lag1	Avg.	Std. Dev. (TEV)	Min	Max	IR	Auto-Corr. Lag1	Corr. w/ RBI TE	Corr. w/ Agg.
Core FI	0.53	1.00	−0.79	1.58	−3.28	2.65	0.05	0.00	0.12	−0.73	0.25	−0.04	0.31	−0.60	−0.24
Core+ FI	0.55	1.01	−0.70	1.63	−3.32	2.81	0.05	0.02	0.26	−0.90	0.77	0.24	0.28	−0.77	−0.18
U.S. Aggregate	0.53	1.02	−0.86	1.65	−3.36	2.65	0.04								

Note: We subtract one basis point per month to approximate after-fee returns in order to be consistent with the after-fee returns for the various hedge fund alpha sources.

Source: eVestment Alliance, Barclays Capital.

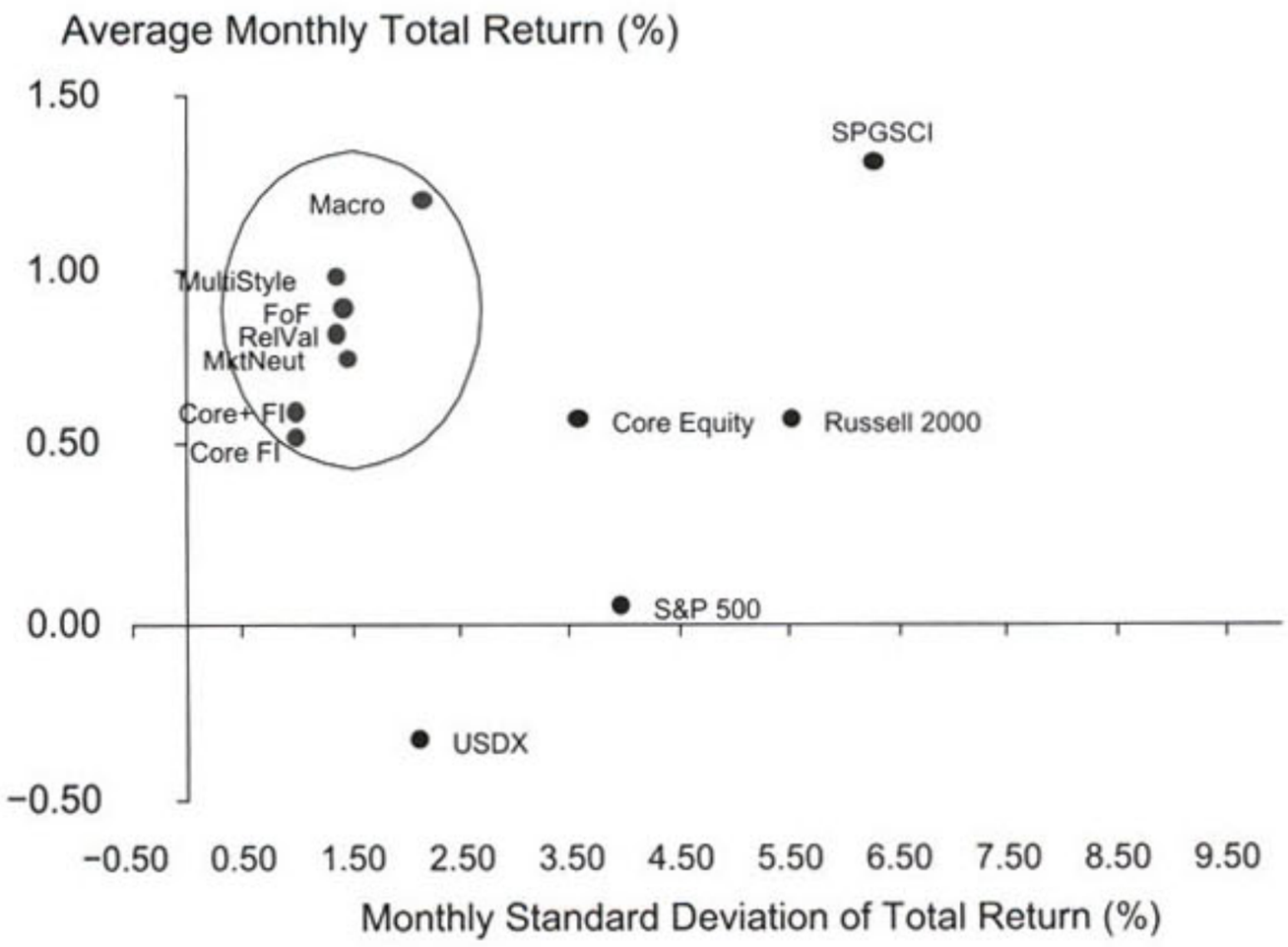
of the Aggregate over the same period. Core+ funds averaged 55 bps per month over the same period, for an average monthly active return of 2 bps. Though producing higher active returns than Core, Core+ funds were more volatile (26 bps per month standard deviation versus 12 bps per month for Core).

Volatility, skew, and kurtosis of the average Core and Core+ manager's total returns are similar to those of the Aggregate. In addition, the extreme monthly returns for Core and Core+ were comparable to the Aggregate. Finally, the first-order autocorrelation for both Core and Core+ total returns is near zero, and less for each of the adjusted hedge fund returns.

Synthetic FI might be considered for FI allocations if its risk were similar to Core and Core+. A comparison of Exhibits 9 and 12 shows that synthetic FI portfolios produced higher, but more variable, total returns; this is not unexpected. For example, Macro +RBI's average monthly total return of 119 bps per month and standard deviation of 218 bps per month compares with an average total return of 55 bps per month and standard deviation of 101 bps per month for Core+. While the four other styles also have monthly total returns higher than traditional FI portfolios, their volatilities are higher as well. However, when compared with other asset classes found in sponsors' portfolios, Exhibit 13 shows that synthetic and traditional FI have relatively similar total return volatilities.

EXHIBIT 13

Total Returns for Synthetic Fixed Income, Traditional Fixed Income, and Other Asset Classes, January 2000–March 2008



Source: HedgeFund.net, eVestment Alliance, Barclays Capital.

Active Returns

Traditional Core and Core+ funds have relatively low average active returns. In addition, reflecting a tendency of Core and Core+ managers to overweight credit, there is negative correlation between their active returns and Aggregate Index returns (Exhibit 14). This is a noticeable difference from synthetic FI, whose active returns show low or positive correlation. Consequently, traditional FI displays less tail dependency with the Aggregate compared to synthetic FI.

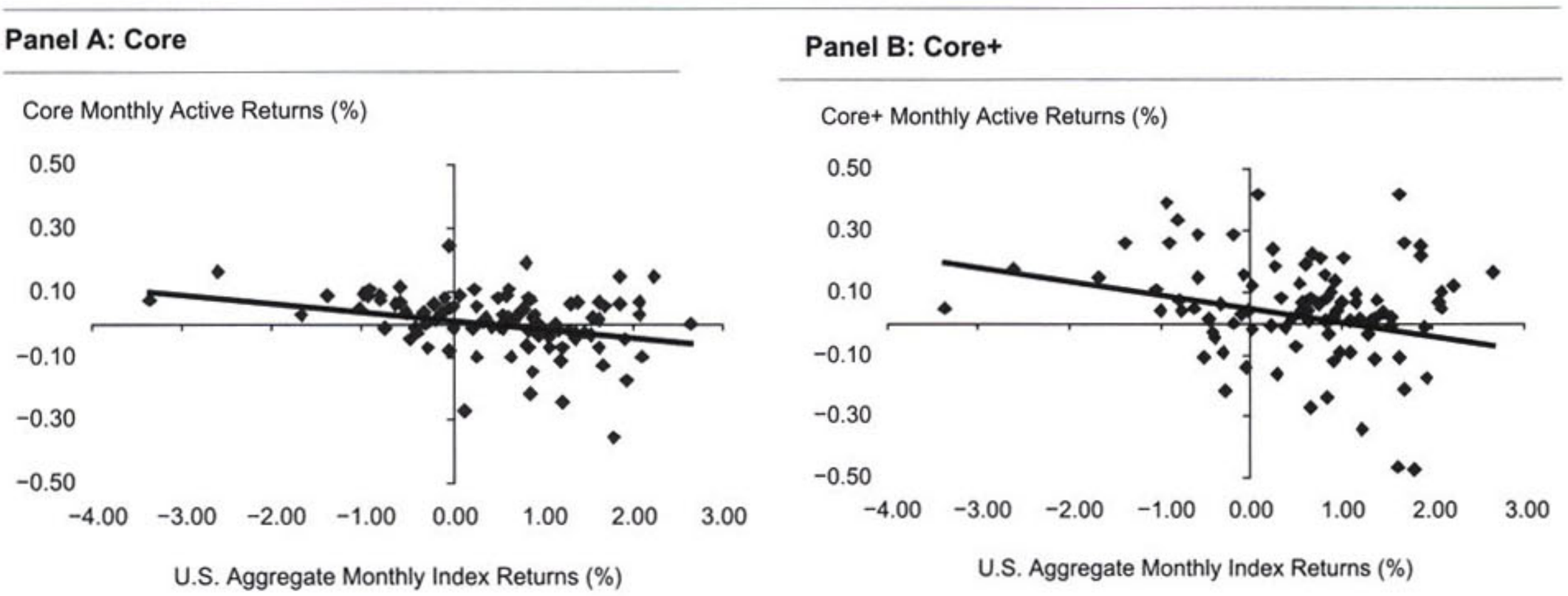
Core and Core+ funds also have relatively low active risk (12 and 26 bps per month, respectively). Active risk (standard deviation of active returns) for RelVal +RBI is 69 bps per month, as shown in Column (c) of Exhibit 9, the lowest of all synthetic FI portfolios, but is nonetheless 2.5 × that of Core+. MktNeut+RBI risk is more than 3.5 ×higher (93 bps per month). Although the multiples of active risk seem large, the active risk from the synthetic strategies is not large relative to active returns in other asset classes (see Exhibit 15, Panel A). Except for Macro +RBI, all other synthetic FI portfolios have active returns less than those of core equity.

One noticeable difference between traditional and synthetic FI total returns is their kurtosis and tail behavior. Traditional FI returns have a kurtosis similar to that of the Aggregate. Although synthetic FI generally has lower kurtosis, large positive active returns coincide with large Aggregate returns. The decline in kurtosis is due to the absence (so far, at least) of large negative synthetic active returns coinciding with large negative Aggregate returns along with large coinciding returns of opposite signs. The comparison of Exhibits 11 and 14 highlights the much smaller magnitude and range of traditional Core and Core+ active returns versus synthetic FI, which limits the scope for deleterious alpha-beta interaction.

For similar reasons, traditional FI managers have similar minimum, and less positive maximum, total returns compared to synthetic FI portfolios (see Exhibit 15, Panel B). So, at least in their tail behavior, the synthetic FI portfolios differ from the traditional ones. Nevertheless, compared to

EXHIBIT 14

Core and Core+ Active Returns vs. Aggregate Index Returns, January 2000–March 2008



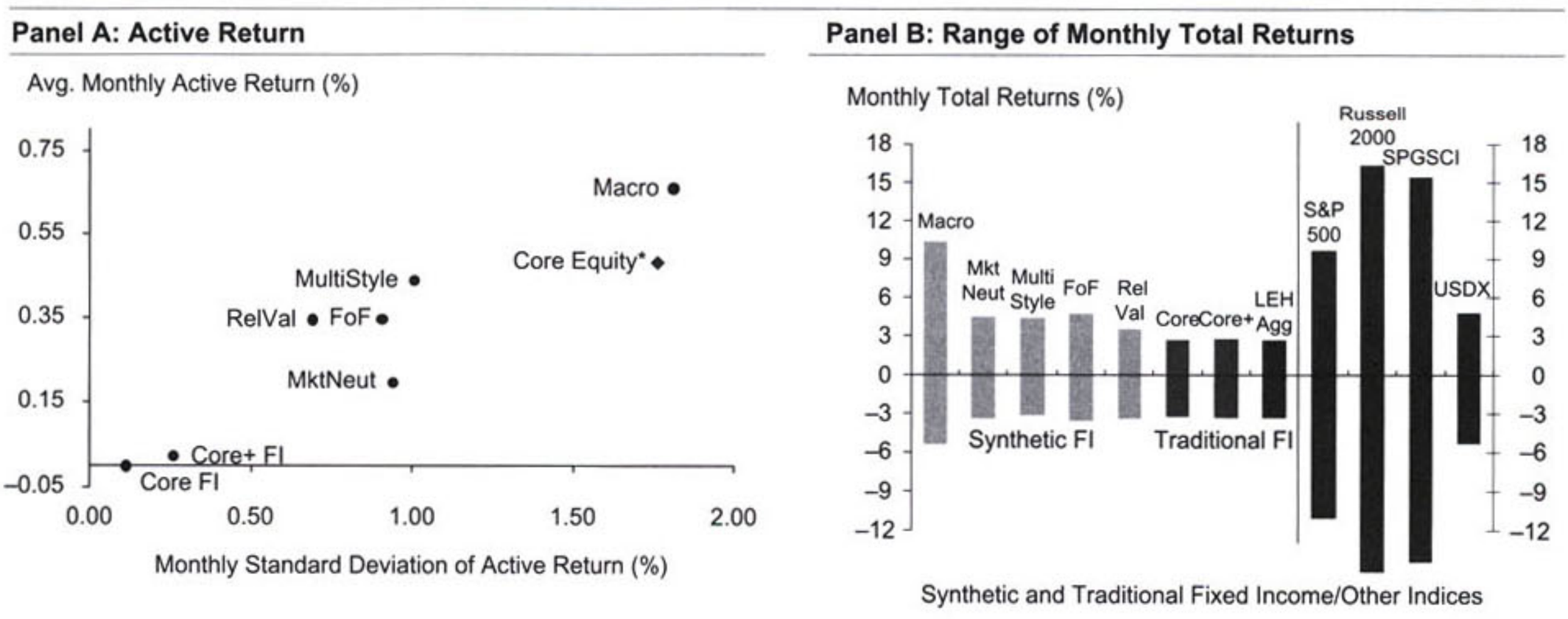
other asset classes in a typical overall portfolio, the extreme behavior of synthetic and traditional FI is similar.

Strategies with different active returns and risks are often compared on the basis of their information ratios (IR) (i.e., active return to active risk). The annualized information ratios for all synthetic FI portfolios handily exceed those of Core and Core+ managers, but with considerable variability. The average Core and Core+ manager has information ratios of –0.04 and 0.24, respectively, while IRs for the average synthetic manager range from 0.75 for MktNeut +RBI to 1.53 for MultiStyle+RBI to 1.71 for RelVal +RBI.

Plan sponsors may not be guided just by information ratios. Very low active returns with even lower active risk produce a very high IR. Investment theory dictates that the sponsor should borrow and lever exposure to

EXHIBIT 15

Comparing Total and Active Returns for Average Synthetic and Traditional Fixed-Income Managers, January 2000–March 2008



**Calculated from the average returns of an equity fund sample from the eVestment Alliance database.*

Source: HedgeFund.net, eVestment Alliance, Barclays Capital.

such a manager up to a desired risk budget in order to maximize active returns. In practice, sponsors are unlikely to use leverage for this purpose.[9] Although the IRs for all synthetic FI strategies exceed those of Core and Core+, a plan sponsor is unlikely to choose a synthetic FI strategy on that basis alone. Instead, he may look at the improvement in active return and then ask if adding the strategy would have a meaningful impact on the plan's overall return volatility. Strategies with low absolute total return volatility, such as synthetic and traditional FI portfolios, are unlikely to greatly affect the plan's overall volatility, so the choice among strategies is likely to depend more on the potential for total return improvement.

For example, while the IR for the FoF +RBI is much higher than that of Core+, the sponsor is likely to focus more on the large improvement of 33 bps per month (35 versus 2 bps per month) in active monthly returns and less on the near 3.5x increase in active risk (92 versus 26 bps per month) because the two strategies have comparable total return volatility in relation to the other asset classes in the portfolio. In addition, while, on average, synthetic FI has higher active returns and risk, a sponsor is likely to ask how replacing traditional FI with synthetic FI would affect the overall risk and return attributes of the plan. Exhibit 16 shows the average monthly total returns and standard deviation for a plan with what is currently a typical asset allocation: 60% equity, 30% FI, 5% alternatives, and 5% cash. The replacement of traditional Core+ FI with synthetic FI has only a modest impact on the plan's overall volatility. For example, the average MultiStyle +RBI synthetic FI manager increases the plan's overall volatility from 221 to 235 bps per month while increasing monthly returns by 12 bps per month. The average MktNeut +RBI synthetic FI manager increases the plan's volatility from 221 to only 223 bps per month while increasing monthly returns by roughly 5 bps per month.

Overall, several synthetic FI portfolios are attractive competitors to traditional FI managers. We found that

- All synthetic FI strategies produce higher active returns and IRs than traditional Core and Core+ managers.
- MktNeut +RBI, MultiStyle +RBI, FoF +RBI, and RelVal +RBI synthetic FI outperform Core+ by 18, 42, 33, and 32 bps per month, respectively, with moderately higher total return volatility. However, the increase in volatility is relatively small in the absolute sense and has negligible impact on a plan's overall volatility.
- MktNeut +RBI, MultiStyle +RBI, FoF +RBI, and RelVal +RBI synthetic FI portfolios have a potential for greater negative tail risk than Core+.
- Macro +RBI synthetic FI outperforms Core+ by 64 bps per month, but is more than twice as volatile. Macro also exhibits considerable tail risk relative to the other FI strategies. Despite a strong IR, Macro + RBI synthetic FI differs the most from traditional FI and may not fit a plan sponsor's definition of fixed income.

EXHIBIT 16

Synthetic vs. Traditional Fixed Income in Typical Asset Allocation, January 2000–March 2008

	Source of Fixed-Income Returns for Typical Allocation (60% Equity, 30% Fixed Income, 5% Alternatives, 5% Cash)						
Monthly Portfolio Return	**Macro**	**MktNeut**	**MultiStyle**	**FoF**	**RelVal**	**Core**	**Core+**
Average	0.75	0.61	0.68	0.66	0.66	0.55	0.56
Std. Dev.	2.48	2.23	2.35	2.30	2.19	2.17	2.21
Minimum	–5.69	–4.89	–5.04	–4.74	–4.32	–4.79	–5.00
Maximum	6.04	6.19	5.61	5.58	5.36	5.25	5.27

Cross-Sectional Performance and Manager Selection Risk

So far, we have only analyzed synthetic FI using the "average" hedge fund manager. Such synthetic FI portfolios have higher active returns and IRs, but potentially worse tail behavior compared to traditional FI portfolios. While synthetic FI appears to be an attractive alternative, there is a reason to proceed with caution. There remains a significant difference between synthetic and traditional FI portfolios: their relative cross-sectional performance or, in other words, the range of performance across managers within a given style. This matters for investors, as they have to select specific managers whose performance may differ from the average manager with volatility well below the average volatility across individual managers.

Not only is there variation in average active returns across managers, but in manager active risk as well. Exhibit 17, Panel A, shows a large difference in active return and active risk across synthetic FI managers. In contrast, there is significantly smaller dispersion in active returns and risk across traditional FI managers (Exhibit 17, Panel B). In selecting a manager, an investor faces not only the risk that the manager's return may fall short of expectations, but also that the manager's volatility may be greater than expected.

Exhibit 18 shows the cross-sectional total, active returns, and active risk for the five styles as well as for Core and Core+. Macro +RBI synthetic FI portfolios using the average manager had a monthly average active return of 66 bps per month with active risk of 182 bps per month. However, the average active return across managers had a range of 525 bps per month (from –231 to 294 bps per month) and a standard deviation of 70 bps per month. In contrast, the average active return for Core+ was 2 bps per month with a standard deviation of 26 bps per month, ranging from –11 to 31 bps per month across managers.

Less dramatically, RelVal +RBI synthetic FI portfolio using the average manager had a monthly average active return of 34 bps per month with a standard deviation over time of 69 bps per month. However, average monthly active returns across managers for RelVal +RBI had a range of 249 bps per month, from –79 to 170 bps per month, with a standard deviation across managers of 42 bps per month. The cross-sectional performance of FoF had the lowest volatility (23 bps per month), which is not surprising because FoF is already an "average" manager to some degree.

Synthetic FI strategies have much more cross-sectional variation than traditional FI. An investor in a synthetic FI portfolio runs a higher risk of selecting a manager that deviates substantially from the "average," compared to selecting a traditional FI manager. This manager selection risk affects the ex ante active risk of the synthetic FI strategy.

EXHIBIT 17

Manager Selection Risk: Average and Standard Deviation of Active Returns for MultiStyle +RBI Synthetic Fixed-Income and Core+ Fixed-Income Managers, January 2000–March 2008

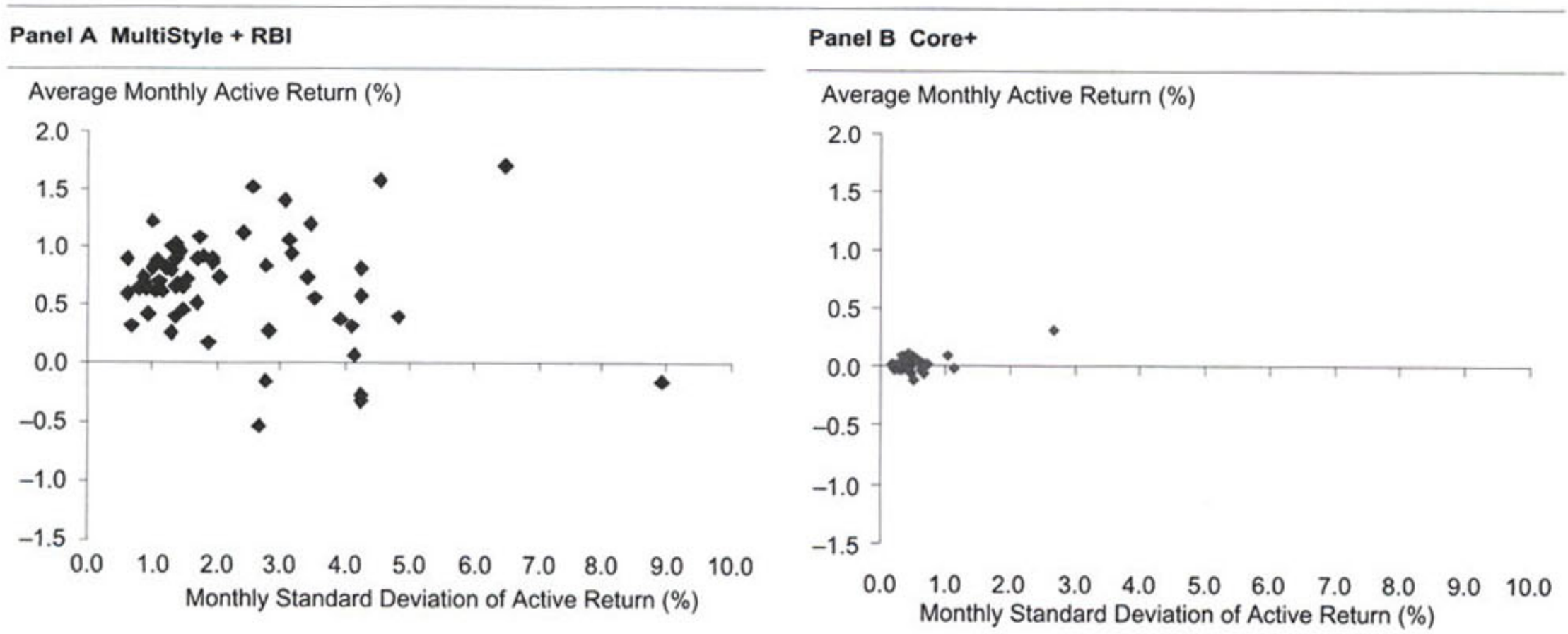


EXHIBIT 18

Cross-Sectional Distribution of Monthly Total and Active Returns, January 2000–March 2008

	Total Returns									Active Returns								Information Ratios				
	Average Manager		Across All Managers							Average Manager		Across All Managers						Avg. Mgr.	Across All Managers			
	Monthly TR	Std, Dev. TR	Monthly TR			Std. Dev. Monthly TR				AR	Std. Dev. AR (TEV)	Monthly AR			Std. Dev. Monthly TR (TEV)			IR	Fund IR			
			Min	Max	σ(a)	Avg	Min	Max	σ(b)			Min	Max	σ(c)	Avg	Min	Max	σ(d)		Avg(e)	Min	Max	σ(f)
Macro + RBI	1.19	2.18	–2.01	3.42	0.73	3.81	1.38	8.10	1.74	0.66	1.82	–2.31	2.94	0.70	3.66	1.01	7.93	1.75	1.25	0.49	–2.59	2.16	0.64
MktNeut + RBI	0.73	1.47	0.27	1.79	0.32	1.92	1.14	5.07	0.75	0.20	0.93	–0.17	1.37	0.33	1.63	0.24	4.88	0.83	0.75	0.68	–0.49	2.28	0.73
MultiStyle + RBI	0.97	1.39	–0.55	2.41	0.56	2.74	1.05	12.50	1.89	0.44	0.99	–0.55	2.41	0.56	2.50	0.60	12.83	2.04	1.53	1.76	–0.71	5.82	1.27
FoF + RBI	0.88	1.45	–0.24	1.99	0.25	1.78	0.97	5.20	0.68	0.35	0.92	–0.50	1.51	0.23	1.40	0.34	5.01	0.79	1.32	0.98	–0.90	5.18	0.69
RelVal + RBI	0.88	1.37	–0.40	2.10	0.44	2.15	1.09	6.39	1.05	0.34	0.69	–0.79	1.70	0.42	1.80	0.42	6.20	1.17	1.71	0.63	–1.73	4.49	1.02
Core	0.53	1.00	0.36	0.60	0.05	1.03	0.81	1.21	0.07	0.00	0.12	–0.11	0.06	0.03	0.24	0.06	0.60	0.11	–0.04	–0.18	–0.96	0.96	0.40
Core+	0.55	1.01	0.43	0.79	0.06	1.10	0.73	3.66	0.43	0.02	0.26	–0.11	0.31	0.07	0.50	0.18	2.68	0.43	0.24	0.10	–0.73	0.94	0.37

[a] Standard deviation across managers of each manager's average monthly TR; [b] Standard deviation across managers of each manager's standard deviation of monthly TR; [c] Standard deviation across managers of each manager's average monthly AR; [d] Standard deviation across managers of each manager's standard deviation of monthly AR; [e] Average Information Ratio = average of the annualized information ratios of each fund in the sample; [f] Std. Dev. IR = distribution of fund level information ratios.

Source: Barclays Capital, Hedgefund.net.

Quantifying Manager Selection Risk ($TEV_{overall}$). We can measure the active risk of the synthetic FI strategy incorporating the cross-sectional manager selection risk. Let TE_i and TEV_i represent, respectively, the monthly TE and TEV of manager i. Manager i is one of N managers the investor can choose from in a given style. The ex ante monthly active risk from selecting a manager at random from among the N managers, which we label "$TEV_{overall}$," can be shown to be

$$TEV_{overall} = \sqrt{\frac{1}{N}\sum_{i=1}^{N} TEV_i^2 + \frac{1}{N}\sum_{i=1}^{N} TE_i^2 - \left(\frac{1}{N}\sum_{i=1}^{N} TE_i\right)^2} \quad (4)$$

The intuition behind this equation follows. The ex ante TEV^2 of selecting a manager at random equals the average TEV^2 across managers plus adjustment for the dispersion of TE^2 across managers. If all managers had the same TE^2, then the last two terms in the square root would cancel each other, and the ex ante TEV^2 would just be the average TEV^2 across managers. Another way to interpret this equation is to imagine all managers having the same TEV^2, but different TE^2. Selecting a manager at random produces a greater TEV^2 than that of a single manager, because of the risk of picking either a well-performing or poorly performing manager. So, when TE^2s vary across managers, the ex ante $TEV_{overall}$ increases.

Using the actual TEs of the synthetic and traditional FI managers, Exhibit 19 presents the expected average active return as well as three measures of TEV—active risk averaged across managers, the ex ante $TEV_{overall}$ of selecting a single manager at random, and the TEV of the "average" manager. The TEV for the average Core+ manager is 26 bps per month and the average across all Core+ managers is 50 bps per month. However, if the sponsor hires a single Core+ manager, the expected $TEV_{overall}$, incorporating the risk of TEV volatility across managers, is 15 bps higher at 65 bps per month. The increase in TEV from the average manager to the $TEV_{overall}$ from picking a single manager is 39 bps per month.

Incorporating cross-sectional selection risk reveals the synthetic FI strategy to be riskier than the "average" manager performance. For example, while the average Macro +RBI manager has TEV of 182 bps per month, the ex ante TEV of a synthetic FI Macro +RBI strategy using a single manager is 411 bps per month, an increase of 229 bps per month.

Although the average RelVal and MktNeut managers look particularly attractive as synthetic FI replace-

EXHIBIT 19

Incorporating Risk of Selecting a Single Manager in Synthetic and Traditional Fixed-Income Portfolios, January 2000–March 2008

	Average Manager (i.e., a portfolio that invests equally in all funds)			Across All Managers		Selecting a Single Manager	
Style	Avg. Monthly TE (Active Return)	TEV	IR (annual)	Avg. Monthly TE (Active Return)	Avg TEV_i	$TEV_{overall}$	IR (annual)
Macro + RBI	0.66	1.82	1.25	0.52	3.66	4.11	0.44
MktNeut + RBI	0.20	0.93	0.75	0.28	1.63	1.82	0.54
MultiStyle + RBI	0.44	0.99	1.53	0.84	2.50	3.26	0.89
FoF + RBI	0.35	0.92	1.32	0.33	1.40	1.39	0.83
RelVal + RBI	0.34	0.69	1.71	0.20	1.80	2.18	0.32
Core	0.00	0.12	–0.04	–0.01	0.24	0.27	–0.16
Core+	0.02	0.26	0.24	0.02	0.50	0.65	0.11

ments for traditional FI, the picture changes when cross-sectional risk is considered. Incorporating cross-sectional manager selection risk increases the TEV of RelVal +RBI and MktNeut +RBI from 69 to 218 bps per month and from 93 to 182 bps per month, respectively. The active risk of RelVal +RBI and MktNeut +RBI synthetic FI strategies is now greater than the active risk of the average equity manager.

As expected, the change in the TEV for FoF was smaller. The TEV for FoF +RBI increased from 92 bps per month for the average FoF manager to a $TEV_{overall}$ of 139 bps per month. Although the TEV of FoF +RBI increases by 47 bps per month, its relative performance improves considerably. FoF +RBI now has much less risk compared to the other synthetic FI strategies. Although synthetic FI has the potential to increase active returns in comparison to traditional FI, the additional risk of picking the wrong manager must be considered.

CONTROLLING MANAGER SELECTION RISK VIA HEDGE FUND REPLICATION

The investor may deal with manager selection risk by diversifying across hedge funds. Diversification may help the investor approach the performance of the "average" synthetic FI portfolio, however, at least five single-style funds (including fund of funds) are needed to approach the TEV of the average portfolio.[10] Diversification, unfortunately, is often expensive and time consuming. In addition, many desirable funds may not be open to new investors.

Another way to approach the average fund performance is to use a hedge fund replication technique that relies on liquid derivatives. Instead of selecting a handful of funds, with the attendant selection risk, the investor can track the average fund indirectly via replication. The trade-off is between the cost and TEV of replicating the average fund of a given style (or a hedge fund index) and the cost (including monitoring and illiquidity costs) and TEV of selecting individual funds.

For example, Barclays Capital offers a "Replicating Hedge Fund Index" (RHFI®) total return swap that provides synthetic hedge fund exposure. The swap pays the total return on a basket of derivatives designed to track a portfolio of hedge funds (or a hedge fund index). In return the investor pays one-month LIBOR + spread. Although the investor is exposed to TE between the RHFI and the corresponding hedge fund bogey (in addition to the swap counterparty risk), this risk may be smaller than the manager selection risk.

Synthetic Hedge Fund Returns Using RHFI Swaps

For each of the five styles we created an RHFI basket designed to track the "average" fund's after-fee adjusted returns. As Exhibit 20 shows, each of the five RHFIs generally tracked the performance of its corresponding average fund, but there was meaningful TEV. For the period April 2004–March 2008,[11] the $MktNeut_{RHFI}$ had an average monthly total return of 47 bps per month and a standard

deviation of 59 bps per month. This compares to 59 and 47 bps per month, respectively, for the average MktNeut fund.[12] In addition, $\text{MktNeut}_{\text{RHFI}}$ had a monthly TEV versus the average MktNeut fund of 54 bps per month. The correlation of monthly returns between the RHFI and the average fund was 0.51, and the monthly TE difference between the RHFI and the average MktNeut fund was –13 bps per month. This pattern is similar for the other styles.

Although the RHFIs tracked their respective "average" funds overall, several months had large divergences, as the magnitudes of the minimum and maximum TE show. For example, the minimum monthly TE for $\text{Macro}_{\text{RHFI}}$ was –503 bps, and for $\text{RelVal}_{\text{RHFI}}$, it was –168 bps. Issues facing synthetic FI investors are whether the TEV of the RHFI versus the average fund exceeds the TEV of selecting individual hedge funds; whether any negative tail dependencies are introduced among the RHFI, average fund return, and beta replication; and the magnitude of any persistent performance shortfall.

Exhibit 4 showed little tail dependency occurs between hedge fund returns and the Aggregate's returns. However, tail dependencies could be introduced through the construction of the synthetic FI portfolio. When hedge fund returns are negative, are RHFI and RBI TEs negative as well?

The correlation of monthly RHFI TE with the average fund monthly return is negative for all five styles (Exhibit 20). In other words, below average RHFI TEs tend to occur when the average hedge fund returns are above average. To check for nonlinear tail dependencies, Exhibit 21 plots monthly RHFI TE versus the average monthly return for $\text{Macro}_{\text{RHFI}}$ and $\text{MktNeut}_{\text{RHFI}}$, and shows little tail dependency. This result holds for the other styles as well. In other words, large negative RHFI TEs do not occur simultaneously with large hedge fund negative returns. If they did, the synthetic FI portfolio returns would display more negative tail behavior. We now turn to the performance of synthetic FI portfolios using RHFI swaps as the alpha source.

Alpha-Beta Recombination with RHFI Swaps

An investor may enter into an RHFI total return swap for a particular style to receive the RHFI total return and pay one-month LIBOR + spread, assumed to be 50 bps per year, which reflects the market level at the time of this writing. Since the investor is not using cash for either hedge fund or beta exposure, we assume cash is invested at one-month LIBOR. As before, to obtain the synthetic beta return, the investor enters into an RBI swap, receives the total return on the RBI, and pays 1-month LIBOR + 15 bps per year. We then generate synthetic FI portfolio returns for various RHFI and RBI combinations. (Note that $\text{Macro}_{\textbf{RHFI}}$ +RBI refers to the average Macro style fund using an RHFI swap plus exposure to the Aggregate via the RBI swap.)

The monthly net RHFI swap return is

$$\text{Monthly Net TR}_{\textbf{RHFI}} = \text{Monthly TR}_{\textbf{RHFI}} - (\text{1-moL} + 50)/12$$

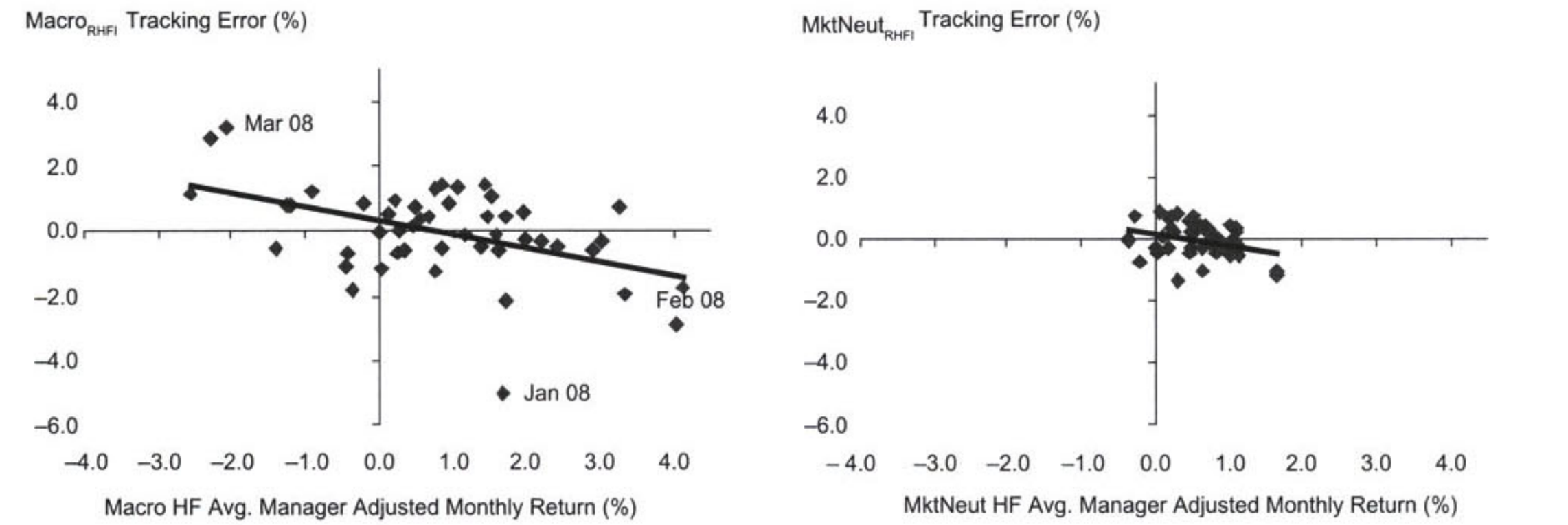
EXHIBIT 20

Monthly RHFI Total Returns and Returns vs. "Average" Fund of Various Hedge Fund Styles and Indices, April 2004–March 2008

	Monthly RHFI Total Returns								RHFI Perf. vs. Average Hedge Fund/HFR Index					
Style	Avg.	Std. Dev.	Skew	Kurtosis	Min	Max	Corr. w/ Avg. HF	Auto-Corr. Lag1	Avg. TE	TEV	Min TE	Max TE	Corr. of TE w/Avg. HF Return	Corr.of TE w/RBI TE
Macro	0.72	1.51	–0.54	0.18	–3.34	4.00	0.57	–0.16	–0.11	1.41	–5.03	3.24	–0.47	–0.37
MktNeut	0.47	0.59	–1.00	0.70	–1.07	1.47	0.51	0.03	–0.13	0.54	–1.37	0.83	–0.32	–0.25
MultiStyle	0.48	1.15	–2.54	11.05	–5.03	2.46	0.49	–0.02	–0.07	1.14	–4.77	3.10	–0.47	–0.22
FoF	0.52	0.95	–0.95	1.88	–2.66	2.26	0.64	–0.02	–0.03	0.87	–1.78	2.08	–0.54	–0.08
RelVal	0.35	0.48	–0.47	–0.01	–0.69	1.34	0.19	0.07	–0.01	0.88	–1.68	4.10	–0.84	0.16
HFRI Composite	0.59	1.17	–0.58	0.12	–2.35	3.22	0.80	0.01	0.04	0.73	–1.52	1.72	–0.24	–0.02

EXHIBIT 21

Monthly RHFI Tracking Error vs. Monthly Average Fund Returns for Macro and MktNeut, April 2004–March 2008



Adding the RHFI swap to the synthetic beta, we have the synthetic FI portfolio total and active returns as follows:

$$\begin{aligned}&\text{Syn FI Monthly TR}_{\text{RHFI}} + \text{RBI}\\&\quad = \text{Monthly Net TR}_{\text{RHFI}} + \text{Monthly TR}_{\text{RBI}}\\&\quad\quad - (\text{1-moL} + 15)/12 + \text{1-moL}/12\\&\quad = [\text{active return of RHFI}] + [\text{RBI return}]\end{aligned} \tag{5}$$

$$\begin{aligned}&\text{Syn FI Active Monthly TR}_{\text{RHFI}} + \text{RBI}\\&\quad = \text{Syn FI Monthly TR}_{\text{RHFI}} - \text{Aggregate Monthly TR}\\&\quad = \text{Monthly TR}_{\text{RHFI}} - (\text{1-moL} + 50)/12\\&\quad\quad + \text{Monthly TR}_{\text{RBI}} - (\text{1-moL} + 15)/12\\&\quad\quad + \text{1-moL}/12 - \text{Aggregate Monthly TR}\\&\quad = [\text{RHFI TE}] + [\text{active hedge fund style return}]\\&\quad\quad + [\text{RBI TE}]\end{aligned} \tag{6}$$

As shown by Equation (5), a synthetic FI portfolio's total return and volatility are affected by both the RHFI active returns and the RBI returns, as well as by their correlation. Equation (6) shows that the active risk of the synthetic FI portfolio is determined by the risk of the underlying hedge fund style, the TEVs of the RHFI and RBI, and their interaction. Exhibit 21 shows the negative correlation between RHFI TEs and hedge fund returns, and little evidence of tail dependencies.

What is the relationship between RBI TEs and RHFI TEs? Do below average RBI TEs tend to occur when RHFI TEs are also below average? If so, this would exacerbate the negative tail behavior of synthetic FI portfolios. Exhibit 22 plots the monthly RBI TEs versus the RHFI TEs for the average Macro and MktNeut funds and shows little tail dependency. In other words, large negative RBI TEs do not occur simultaneously with large negative RHFI TEs. Consequently, given the relatively small absolute magnitude of RBI TEs, the synthetic FI portfolio will not have much stronger negative tail behavior than the underlying RHFI returns.

Exhibit 23 compares the relative performance of synthetic FI portfolios for each style, using either RHFI or the average hedge fund that RHFI attempts to replicate. Compared with the average fund, the RHFI synthetic FI portfolio monthly active returns (TE relative to the Aggregate) are lower for all five styles with a comparable standard deviation (TEV). Consequently, information ratios for RHFI synthetic FI are lower than the IRs of synthetic FI using the average manager (e.g., 0.86 vs. 2.11 for MktNeut +RBI).

In terms of tail behavior of total returns, the minimum total returns using RHFI are larger in absolute value for four of the five styles, with Macro being the exception, and the maximum total returns using RHFI

EXHIBIT 22

Monthly RBI Tracking Error vs. RHFI Tracking Error for Macro and MktNeut, April 2004–March 2008

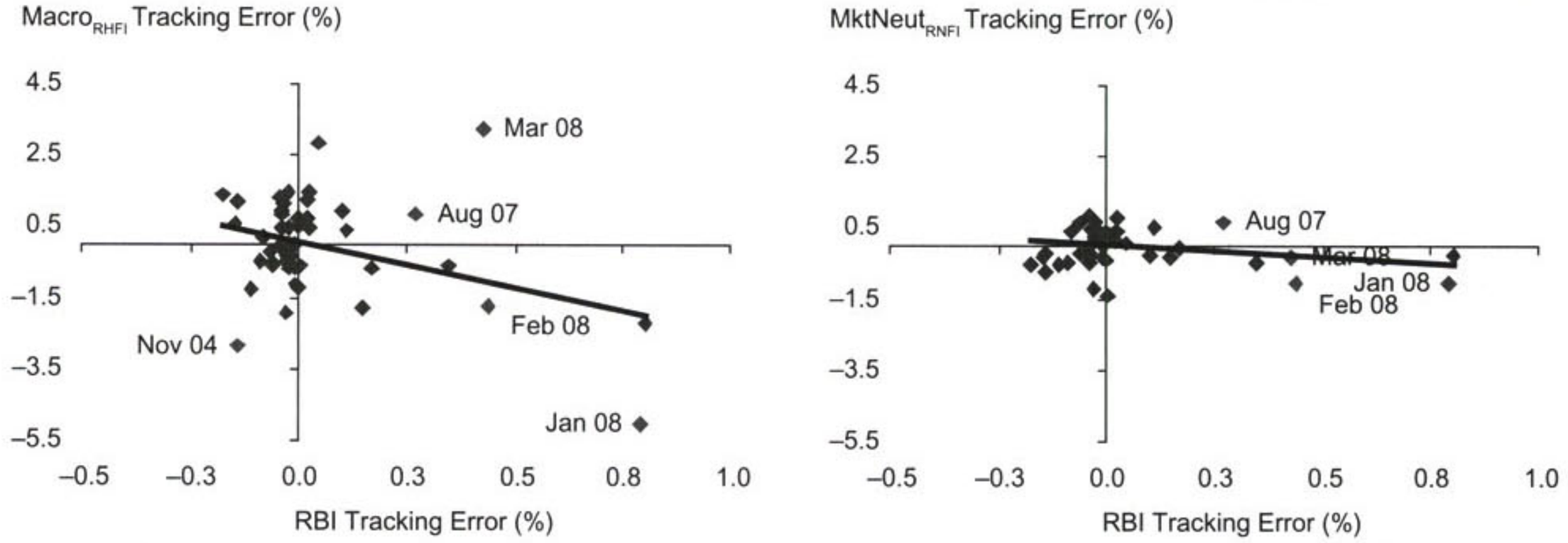


EXHIBIT 23

Synthetic Fixed-Income Portfolio Performance Using RHFI and RBI Compared to Synthetic Fixed-Income Portfolio Using the "Average" Fund, April 2004–March 2008

	Synthetic Fixed-Income Using RHFI												Synthetic Fixed-Income Using the Average Fund/Indices									
	Total Returns							Active Returns					Total Returns				Active Returns					
Style	Avg	Std. Dev.	Skew	Kurt.	Min	Max	Auto-Corr. Lag 1	Avg. (TE)	Std. Dev. (TEV)	Min	Max	IR (annual)	Avg.	Std. Dev.	Min	Max	Avg. (TE)	Std. Dev. (TEV)	Min	Max	IR (annual)
Macro	0.74	1.75	−0.78	0.63	−4.34	3.60	−0.01	0.38	1.46	−3.07	3.52	0.91	0.89	1.84	−5.39	4.43	0.53	1.53	−2.79	4.29	1.21
MktNeut	0.49	1.15	−1.45	3.47	−3.95	2.22	0.11	0.13	0.51	−1.62	0.99	0.86	0.65	1.01	−3.07	2.71	0.30	0.49	−0.72	1.83	2.11
MultiStyle	0.51	1.33	−1.26	2.49	−3.92	2.88	0.08	0.15	1.04	−4.76	1.82	0.49	0.61	1.24	−3.02	2.51	0.26	1.04	−3.03	2.29	0.86
FoF	0.54	1.31	−1.01	1.75	−3.93	2.54	0.09	0.19	0.85	−2.39	1.71	0.75	0.62	1.28	−3.36	2.96	0.26	1.02	−2.18	2.17	0.89
RelVal	0.37	1.10	−1.15	2.69	−3.66	2.40	0.09	0.02	0.42	−1.06	0.77	0.13	0.43	1.18	−3.05	3.29	0.07	0.74	−3.39	1.61	0.32
HFRI Composite	0.61	1.43	−1.01	2.07	−4.41	3.03	0.12	0.25	1.07	−2.10	2.74	0.82	0.57	1.27	−4.23	2.43	0.21	1.02	−1.63	2.41	0.72
Core													0.33	0.86	−2.44	1.86	−0.03	0.14	−0.73	0.17	−0.65
Core+													0.35	0.86	−2.41	1.90	−0.01	0.21	−0.81	0.33	−0.13
U.S. Aggregate													0.36	0.91	−2.60	1.91					

Note: Synthetic FI Returns using the average hedge fund manager (i.e., the adjusted return series the RHFI is attempting to replicate) are from Exhibit 9.

Source: Barclays Capital.

are smaller for four of the five styles, with MultiStyle being the exception.

As with average hedge fund returns, we looked for tail dependency between RHFI synthetic FI portfolio active returns and Aggregate Index returns. Exhibit 24 plots the monthly synthetic FI active returns for Macro$_{RHFI}$ + RBI and MktNeut$_{RHFI}$ + RBI against Aggregate returns and shows only modest tail dependency.

Comparing RHFI Synthetic Fixed-Income Returns with Diversified Hedge Fund Portfolios

Is synthetic FI using RHFI a compelling option? How does it compare with diversified portfolios of funds in terms of mitigating manager selection risk? Exhibit 25 presents a comparison of the TE, TEV, and IR of synthetic FI (with RBI as the beta source) for each style using

EXHIBIT 24

Monthly Synthetic Fixed-Income Active Returns of $Macro_{RHFI}$ + RBI and $MktNeut_{RHFI}$ + RBI vs. Monthly Aggregate Returns, April 2004–March 2008

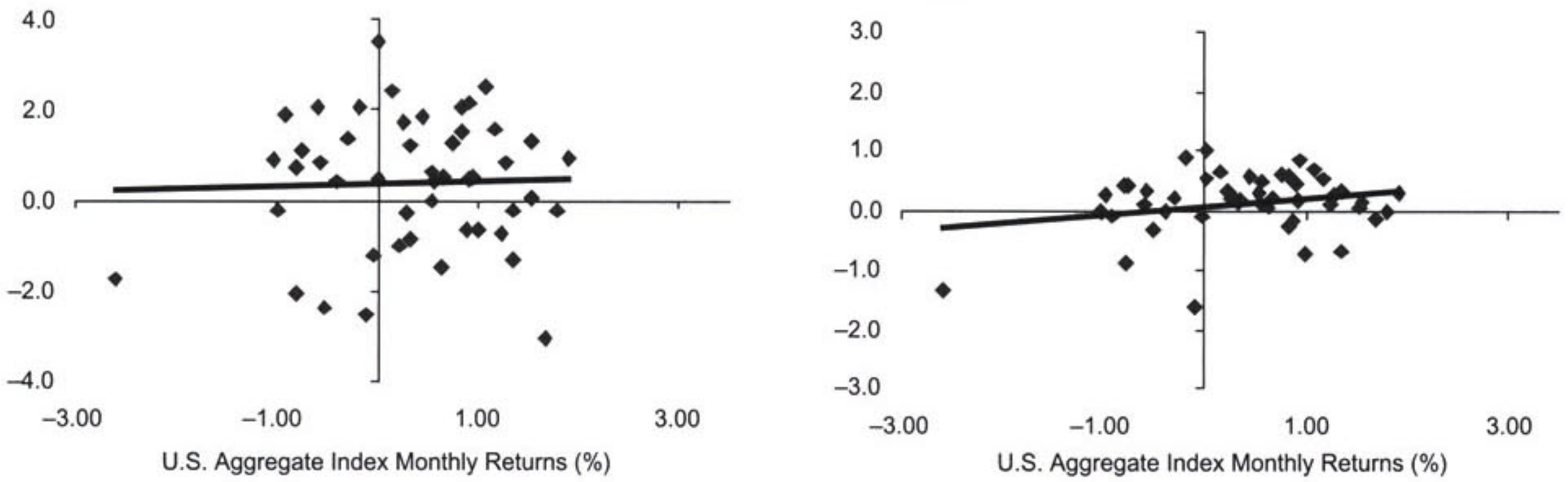


EXHIBIT 25

Synthetic Fixed-Income Performance Using RBI for Single- and Five-Fund Portfolios, RHFI, and Average Fund, April 2004–March 2008

	Across All Single-Fund Synthetic Fixed-Income Portfolios			Across All Synthetic Five-Fund Fixed-Income Portfolios			RHFI			Average Manager/Index		
Style	Avg. TE_i	$TEV_{Overall}$	IR (annual)	Avg. TE_i	$TEV_{Overall}$	IR (annual)	Avg. TE_{RHFI}	TEV_{RHFI}	IR (annual)	TE	TEV	IR (annual)
Macro	0.49	4.04	0.42	0.59	2.42	0.85	0.38	1.46	0.91	0.53	1.53	1.21
MktNeut	0.25	1.61	0.53	0.28	0.83	1.16	0.13	0.51	0.86	0.30	0.49	2.11
MultiStyle	0.16	2.71	0.21	0.21	1.45	0.49	0.15	1.04	0.49	0.26	1.04	0.86
FoF	0.25	1.56	0.55	0.25	1.13	0.77	0.19	0.85	0.75	0.26	1.02	0.89
RelVal	0.07	1.86	0.12	0.10	0.94	0.37	0.02	0.42	0.13	0.07	0.74	0.32
Core	–0.02	0.27	–0.23	–0.02	0.17	–0.34				–0.03	0.14	–0.64
Core+	0.00	0.54	0.00	0.00	0.29	0.01				–0.01	0.21	–0.12

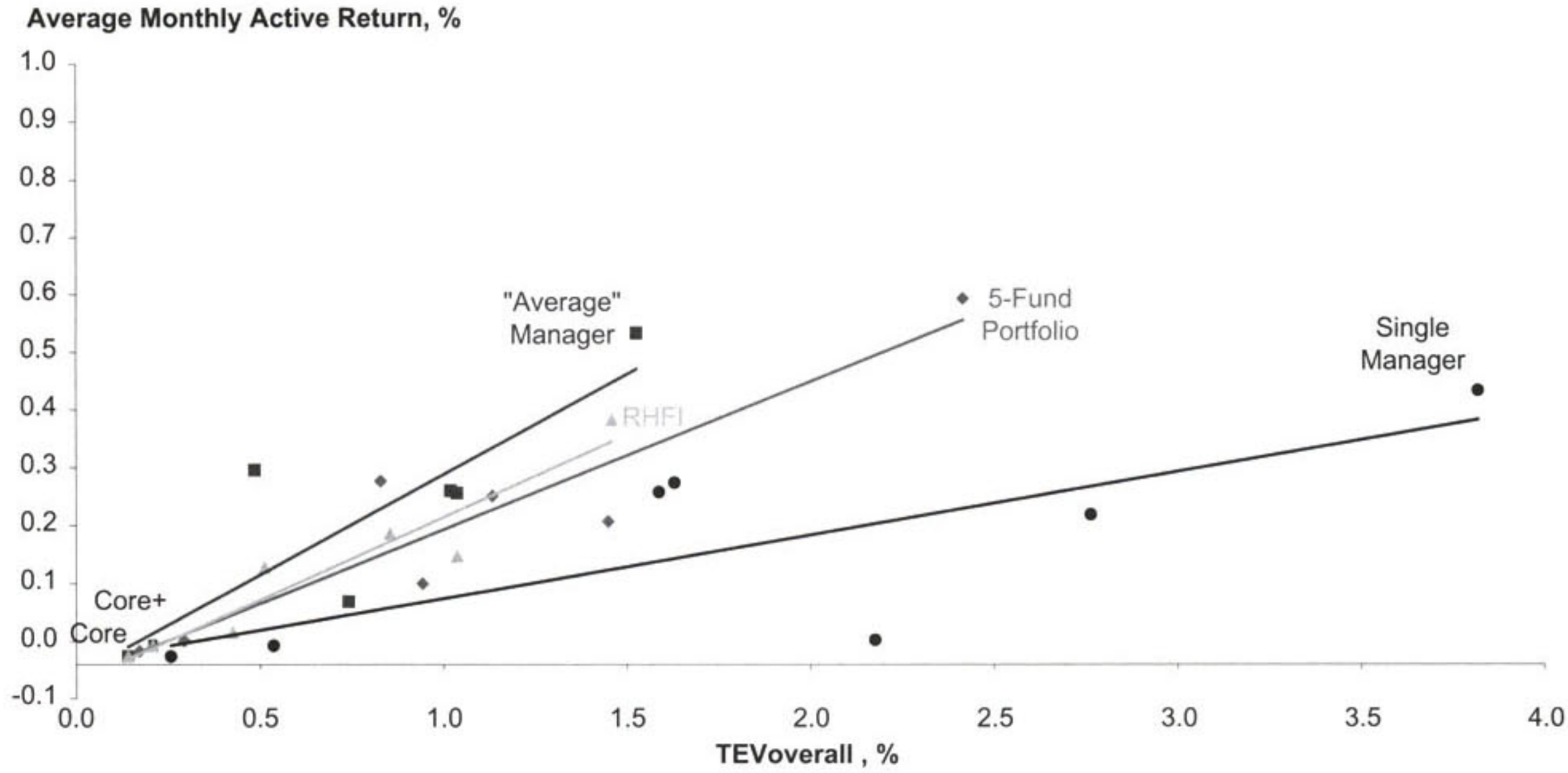
a single hedge fund chosen at random (i.e., bearing full manager selection risk), diversified five-fund portfolios, synthetic hedge fund replication using RHFI, and the average hedge fund.

We think it is apparent that RHFI synthetic FI is superior to a single-fund portfolio with its concomitant manager selection risk. While the RHFI TEs are lower than those for the single-fund synthetic FI, the TEVs are lower still, producing superior IRs. In addition, RHFI added little negative tail behavior to the synthetic FI strategy.

How did RHFI perform versus the unobtainable "average" synthetic FI portfolio? While TEV_{RHFI} is close to (sometimes lower than) that of the average fund, the monthly TE is lower for each of the five styles. On a risk-adjusted basis, the IR of synthetic FI using RHFI is lower than the average fund IR for all styles. However, of practical importance is that although the TE_{RHFI} and IR are lower than those of the average fund, they are still substantially greater than single-manager Core and Core+ TEs and IRs, making synthetic FI using RHFI a viable FI portfolio solution.

EXHIBIT 26

Performance Opportunity Lines: Comparing Opportunities Offered by Various Fixed-Income Strategies, April 2004–March 2008



But how does RHFI compare with a diversified portfolio of funds in synthetic FI? The results are mixed. All RHFI portfolios have lower returns than five-fund portfolios of the same style. However, some RHFI portfolios also have lower TEV and therefore produce an IR similar to that of a five-fund portfolio of the same style. Others have lower IRs. In general, the performance of RHFI portfolios is in the vicinity of that of five-fund portfolios. Given the expense and illiquidity of investing in several hedge funds, RHFI synthetic FI portfolios are a compelling idea.

Exhibit 26 summarizes these findings. For each synthetic FI strategy (e.g., using the average fund of a given style, using RHFI for a style, and using a five-fund portfolio) we construct a fitted *performance opportunity line* in active return versus $TEV_{overall}$ space. For example, the RHFI performance opportunity line represents the return–TEV trade-off across the various fund styles for synthetic FI investors. A steeper line means a greater opportunity to increase active return for a given level of risk. The exhibit shows that the incorporation of manager selection risk rotates the line downward from the average-fund line. Using hedge fund replication to reduce manager selection risk, however, rotates the line back upward toward the average-fund line. The RHFI line does not reach the average line because of the additional TEV from attempting to replicate the average-fund performance. Finally, the exhibit shows that RHFI is competitive against a five-fund diversification strategy.

CONCLUSION

The attractiveness of synthetic fixed income relative to the traditional cash alternative rests on three dynamic factors: the absolute returns and volatility of the alpha source, the performance of the beta replication strategy, and the alpha-beta interaction.

From January 2000 through March 2008, each of the five hedge fund styles that we investigated (Macro, Market Neutral, Broad Relative Value, Multi-Style, and Fund of Funds) generated, on average, higher active returns and information ratios than traditional fixed-income managers. MktNeut, MultiStyle, FoF, and RelVal all produced solid active returns (20, 44, 35, and 34 bps per month, respectively), with monthly total return volatilities between 1.3x and 1.4x that of the Aggregate. Each style is thus an attractive candidate for a synthetic fixed-income portfolio and is likely to provide an incremental performance boost with modest incremental increase in overall portfolio volatility. On average, Macro hedge funds had the highest

active return, but with the highest return volatility (almost twice that of the Aggregate).

Return volatility is only one consideration for a synthetic fixed-income investor. Equally important are the tail risk and the interaction of the alpha source, the underlying beta, and any beta replication errors. Synthetic fixed-income portfolios exhibit less negative skew and less positive kurtosis than the Aggregate Index. Despite the better skewness and kurtosis of the synthetic FI portfolios, as well as evidence of low (or negative) correlation between hedge fund active returns and synthetic beta returns, periods exist when the two moved in concert, producing synthetic returns more extreme than either the fund returns or the Aggregate Index returns. In comparison with the traditional FI asset class, tail risk is greater in synthetic fixed income.

The appeal of using hedge funds in synthetic fixed-income portfolios is clear if the sole focus is on the returns and volatility of the average manager of a given style. However, the wide distribution of returns among managers within a particular style introduces another layer of risk—picking a wrong manager. This risk is particularly apparent against the backdrop of clustered returns of traditional Core and Core+ managers. Manager selection risk contributes to the ex ante active risk of the synthetic fixed-income strategy.

Incorporating manager selection risk makes synthetic fixed income look somewhat less attractive. Manager selection risk also changes the relative attractiveness of particular alpha sources. On the one hand, MktNeut and RelVal look less attractive when this risk is considered. Their TEV jumps substantially when, instead of assuming the uninvestable "average" manager, we move to the reality of selecting a single manager out of many. On the other hand, the case for synthetic fixed income is enhanced with FoF.

An innovative way to control manager selection risk is to replicate hedge fund returns with baskets of liquid derivatives mimicking the average synthetic fixed-income manager. An investor can obtain hedge fund exposure via a total return swap on such a basket, designed, for example, to track the average Multi-Style hedge fund. The trade-off for the investor is between manager selection risk and the tracking error of the replicating portfolio versus the average manager.

ENDNOTES

[1]In November 2008, Lehman Brothers Indices were rebranded as Barclays Capital Indices. The index rules and return calculations were unchanged.

[2]In a given month, the return for the average fund is an equal-weighted average of returns of all funds of a given style.

[3]Graphs for the other styles are available from the authors.

[4]Alternatively, the investor could invest in the alpha source directly and be the counterparty to the RBI swap. He would then have to manage monthly swap payments, either through partial redemptions, a liquidity provision embedded in the RBI swap, or external financing.

[5]Plots for the other synthetic FI portfolios are available from the authors.

[6]The eVestment Alliance is a third-party database and analytic tool used by investment consultants, investment managers, and plan sponsors. It covers over 5,500 institutional accounts. Monthly and quarterly fund returns are self-reported to eVestment Alliance by managers.

[7]Our FI Core sample includes 56 firms from 2004 to 2007, with a total AUM of $347 billion as of 3Q07, from 53 funds. All managers had AUM of at least $750 million. Passive index managers were excluded. Only a single performance record per manager was used. Reported performance is before fees. However, we make an adjustment for fees when reporting results in the exhibits that follow.

[8]Our FI Core+ sample includes 39 firms from 2004 to 2007, with a total AUM of $550 billion as of 3Q07, from 39 funds. All managers had AUM of at least $500 million. Only a single performance record per manager was used. Reported performance is before fees. However, we make an adjustment for fees when reporting results in the exhibits that follow.

[9]This may seem inconsistent. Alpha-beta recombination is a leverage strategy that effectively borrows to obtain the beta return. So, why wouldn't a plan sponsor borrow to leverage exposure to a high IR fund? The answer may be manager selection risk, which will be discussed later in the article.

[10]The details of this separate study are available from the authors.

[11]RHFI swaps returns are available since April 2004.

[12]Returns for the average hedge fund manager for the April 2004–March 2008 period are generated using the data underlying Exhibit 2.

RBI® is a registered trademark of Barclays Capital Inc. Patent pending.

To order reprints of this article, please contact Dewey Palmieri at dpalmieri@iijournals.com or 212-224-3675.