Risk & Return Fixed Income Arbitrage:
Nickels in Front of a Steamroller

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Fixed Income Arbitrage

- Broad set of market-neutral strategies intended to exploit valuation differences between various fixed income securities
- Swap spread arbitrage
- Yield curve arbitrage
- Mortgage arbitrage
- Volatility arbitrage
- Capital structure arbitrage

Introduction

- Fixed income arbitrage is one of the most popular and long lasting hedge fund strategies.
- However, during LTCM hedge fund crisis of 1998, was one of the most toxic strategies around.

   --- Too much leverage?

   --- Is it really arbitrage?

   --- Just a strategy that earns small returns

      most of the time, then has dramatic losses?

Introduction

- The study backtests 5 popular FI arb strategies using more than 16 years data.
- To hold fixed the leverage component to make sure pure strategy is being tested. We already know that too much leverage can be fatal; so abstract from this and use enough capital to make sure returns have 10 percent volatility.

Swap Spread Arbitrage

- Lowenstein (2000) reports that LTCM lost $1.6 billion on swap spread positions.
- Strategy is simple. Receive in swaps and short corresponding Treasury bond, or vice versa. If swap spread larger than Libor-repo spread, positive carry.

Swap Spread Comparison
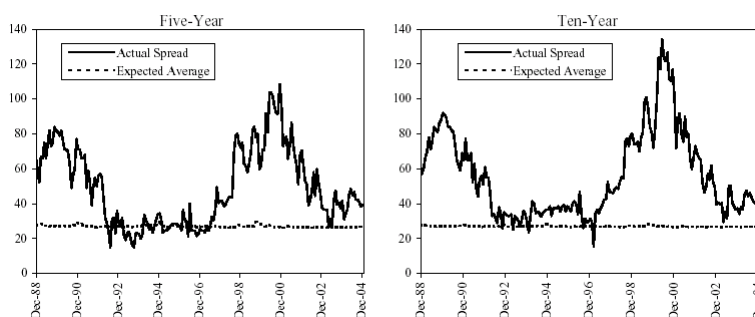
Swap Spread Returns

Strategy	Swap	N	Capital	Mean	t-Stat	Std. Dev.	Min.	Max.	Skew.	Kurt.	Ratio Neg.	Serial Corr.	Gain/ Loss	Sharpe Ratio
SS1	2 yr	193	3.671	0.546	2.94	2.887	−9.801	11.552	0.449	2.454	0.326	−0.113	1.758	0.655
SS2	3 yr	193	5.278	0.476	3.01	2.887	−8.482	11.209	0.178	2.002	0.326	−0.269	1.629	0.571
SS3	5 yr	193	9.047	0.305	1.68	2.887	−10.663	10.163	−0.456	2.269	0.332	−0.135	1.372	0.366
SS4	10 yr	193	15.795	0.313	1.69	2.887	−10.761	10.004	0.069	2.711	0.425	−0.114	1.381	0.376
EW SS		193	8.448	0.410	2.78	2.378	−8.569	8.439	−0.111	2.505	0.394	−0.148	1.643	0.597

Yield Curve Arbitrage

- Use two factor model to identify and hedge 1, N, and 10 year butterfly trades on the swap curve.
- Very popular FI hedge fund strategy.
- More intellectual capital required than just duration and convexity neutral trading.

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Yield Curve Returns

Strategy	Swap	N	Capital	Mean	t-Stat	Std. Dev.	Min.	Max.	Skew.	Kurt.	Ratio Neg.	Serial Corr.	Gain/ Loss	Sharpe Ratio
YC1	2 yr	193	4.847	0.540	2.76	2.887	−6.878	10.056	0.569	0.902	0.301	−0.059	1.770	0.648
YC2	3 yr	193	7.891	0.486	2.31	2.887	−6.365	11.558	0.591	1.172	0.337	0.014	1.643	0.583
YC3	5 yr	193	7.794	0.615	3.29	2.887	−8.307	11.464	0.592	2.366	0.212	−0.108	2.102	0.738
YC4	7 yr	193	4.546	0.437	2.46	2.887	−10.306	20.032	2.156	14.953	0.088	−0.158	2.355	0.524
EW YC		193	6.270	0.519	3.42	2.293	−5.241	11.329	0.995	3.269	0.347	−0.084	1.980	0.785

Mortgage Arbitrage

- Strategy takes MBS positions and hedges them using swaps.
- Some sort of prepayment model required to identify correct hedge ratios.

Mortgage Returns

Strategy	Mortgage	N	Capital	Mean	t-Stat	Std. Dev.	Min.	Max.	Skew.	Kurt.	Ratio Neg.	Serial Corr.	Gain/ Loss	Sharpe Ratio
MA1	Discount	97	21.724	0.691	2.08	2.887	−6.794	11.683	0.882	2.929	0.383	0.128	1.999	0.830
MA2	Par	97	19.779	0.466	1.50	2.887	−7.600	11.676	0.330	2.263	0.402	0.059	1.565	0.560
MA3	Premium	97	16.910	0.065	0.23	2.887	−8.274	9.844	−0.274	1.452	0.402	−0.052	1.063	0.078
EW MA		97	19.471	0.408	1.39	2.750	−7.556	8.539	6.369	1.027	0.392	0.053	1.489	0.514

Fixed Income Volatility Arbitrage

- Short interest rate caps and delta hedge them using Eurodollar futures.
- Low tech strategy; model not really needed if one used straddles.

Volatility Returns

Strategy	Cap	N	Capital	Mean	t-Stat	Std. Dev	Min.	Max.	Skew.	Kurt.	Ratio Neg.	Serial Corr.	Gain/ Loss	Sharpe Ratio
VA1	2 yr	183	0.734	0.389	1.11	2.887	−9.720	6.550	−0.962	1.579	0.383	0.465	1.423	0.467
VA2	3 yr	183	0.863	0.609	1.77	2.887	−9.675	6.851	−0.909	1.332	0.355	0.445	1.722	0.731
VA3	4 yr	183	0.953	0.682	2.08	2.887	−10.295	7.087	−0.989	1.644	0.311	0.409	1.823	0.819
VA4	5 yr	150	1.082	0.488	1.32	2.887	−9.997	6.654	−0.988	1.772	0.347	0.423	1.543	0.586
EW VA		183	0.908	0.584	1.79	2.280	−9.592	6.674	−0.925	1.392	0.344	0.425	1.709	0.720

Capital Structure Arbitrage

- Need to use a structural model to estimate what a firm's CDS level should be.
- The trade is equity vs. CDS where hedge ratios are determined from model. A high level of modeling involved.

Capital Structure Returns

Strategy	Rating	Trigger	N	Capital	Mean	t-Stat	Std. Dev.	Min.	Max.	Skew.	Kurt.	Ratio Neg.	Serial Corr.	Gain/ Loss	Sharpe Ratio
CS1	Invst.	1.00	48	47.000	0.768	1.95	2.887	−8.160	10.570	0.223	5.337	0.271	−0.055	2.621	0.922
CS2		1.50	48	52.300	0.613	1.25	2.887	−8.020	12.770	0.266	8.682	0.375	0.162	2.435	0.735
CS3		2.00	48	44.900	0.731	1.30	2.887	−4.640	13.790	0.342	10.075	0.417	0.296	3.341	0.877
CS4	Spec.	1.00	48	86.900	0.709	2.30	2.887	−8.680	7.080	0.331	2.646	0.167	−0.298	2.513	0.851
CS5		1.50	48	90.500	0.669	2.17	2.887	−7.250	10.920	0.358	4.661	0.146	−0.306	2.921	0.802
CS6		2.00	48	75.900	0.740	1.03	2.887	−1.730	15.210	0.448	15.889	0.104	0.505	12.738	0.887
EW CS			48	66.250	0.705	1.70	2.029	−1.955	9.650	2.556	8.607	0.333	0.343	4.117	1.203

What is the Alpha?

Strategy	Without Fees		With Fees	
	α	t-Stat	α	t-Stat
SS1	0.350	1.44	0.115	0.59
SS2	0.204	0.85	0.019	0.10
SS3	−0.080	−0.36	−0.194	−1.04
SS4	−0.136	−0.62	−0.286	−1.45
EW SS	0.084	0.45	−0.087	−0.55
YC1	0.582	2.36	0.322	1.61
YC2	0.521	2.14	0.283	1.38
YC3	0.638	2.64	0.373	1.86
YC4	0.653	2.74	0.387	1.95
EW YC	0.598	3.14	0.341	2.17
MA1	0.725	2.12	0.478	1.56
MA2	0.555	1.61	0.322	0.99
MA3	0.157	0.47	0.016	0.05
EW MA	0.479	1.47	0.272	0.89

Strategy	Without Fees		With Fees	
	α	t-Stat	α	t-Stat
VA1	0.074	0.29	−0.098	−0.48
VA2	0.305	1.21	0.078	0.38
VA3	0.415	1.65	0.166	0.82
VA4	0.228	0.83	0.005	0.03
EW VA	0.308	1.26	0.084	0.42
CS1	1.073	1.66	0.734	1.35
CS2	0.803	1.34	0.619	1.06
CS3	1.076	1.70	0.787	1.41
CS4	0.432	0.69	0.228	0.42
CS5	1.150	1.67	0.817	1.30
CS6	1.235	1.95	0.893	1.64
EW CS	0.961	2.11	0.680	1.69
EW All	0.375	3.38	0.147	1.62
EW YC,MA,CS	0.525	3.56	0.275	2.28
CSFB	–	–	0.412	3.87
HFRI	–	–	0.479	4.22

Conclusion

- How do capital flows affect returns?
- Seems to be something there. FI arb strategies actually add positive alpha.
- Strategies that require more intellectual capital do the best.

Appendix:

Swap Spread Arbitrage

- Two legs strategy
- Arbitrageur enters into a par swap and receives a fixed coupon rate CMS and pays the floating rate Libor rate L_t
- Arbitrageur shorts a par Treasury bond with the same maturity as the swap, pays a fixed coupon rate CMT, and invests the proceeds in a margin account earning the repo rate r_t,
- Arbitrageur receives fixed SS=CMS-CMT & pays the floating spread $S_t = L_t - r_t$

Table 1

Summary Statistics for the Swap Spread Arbitrage Strategy. This table reports the indicated summary statistics for the monthly percentage excess returns from the swap spread arbitrage strategy. Trigger denotes the basis-point difference between the swap spread and the expected average Libor-repo spread that is required to implement the strategy. Swap denotes the swap maturity used in the strategy. N denotes the number of monthly excess returns. Capital is the initial amount of capital required per \$100 notional of the arbitrage strategy to give a ten-percent annualized standard deviation of excess returns. The t-statistics for the means are corrected for the serial correlation of excess returns. Ratio Neg. is the proportion of negative excess returns. The sample period for the strategy is December 1988 to December 2004.

Strategy	Trigger	Swap	N	Capital	Mean	t-Stat	Min.	Med.	Max.	Skew.	Kurt.	Ratio Neg.	Serial Corr.	Sharpe Ratio
SS1	10 bp	2 yr	193	3.453	0.548	2.66	−12.549	0.000	10.610	−0.025	2.722	0.342	−0.010	0.657
SS2		3 yr	193	4.755	0.601	3.57	−9.389	0.151	13.827	0.580	3.072	0.316	−0.208	0.722
SS3		5 yr	193	7.462	0.418	2.16	−13.263	0.000	8.275	−0.491	3.030	0.285	−0.073	0.501
SS4		10 yr	193	15.063	0.297	1.66	−10.626	0.122	10.526	−0.157	2.791	0.394	−0.152	0.356
SS5	20 bp	2 yr	193	2.959	0.318	1.47	−15.063	0.000	12.352	0.005	6.392	0.181	0.038	0.381
SS6		3 yr	193	4.110	0.461	2.75	−10.825	0.000	16.174	0.491	6.595	0.155	−0.211	0.554
SS7		5 yr	193	7.164	0.325	1.75	−11.312	0.000	9.320	−0.415	2.459	0.275	−0.111	0.390
SS8		10 yr	193	14.642	0.323	1.75	−11.064	0.000	11.229	−0.094	3.687	0.295	−0.118	0.388

Yield Curve Arbitrage

- Identification of "cheap" & "rich" points on the yield curve
- Investor exploits the mis-valuations by going long/short to minimise portfolio risk
- Portfolio held until the trade converges, relative values of the bonds come back into line
- Strategy requires the application of a multi-factor term structure model

Table 2

Summary Statistics for the Yield Curve Arbitrage Strategy. This table reports the indicated summary statistics for the monthly percentage excess returns from the yield curve arbitrage strategy. Trigger denotes the basis-point difference between the model and market values of the swap required to implement the strategy. Swap denotes the swap maturity used in the strategy. N denotes the number of monthly excess returns. Capital is the initial amount of capital required per \$100 notional of the arbitrage strategy to give a ten-percent annualized standard deviation of excess returns. The t-statistics for the means are corrected for the serial correlation of excess returns. Ratio Neg. is the proportion of negative excess returns. The sample period for the strategy is December 1988 to December 2004.

Strategy	Trigger	Swap	N	Capital	Mean	t-Stat	Min.	Med.	Max.	Skew.	Kurt.	Ratio Neg.	Serial Corr.	Sharpe Ratio
YC1	5 bp	2 yr	193	5.476	0.460	2.38	−6.072	0.000	10.099	0.521	0.469	0.394	−0.075	0.552
YC2		3 yr	193	8.499	0.509	2.38	−5.895	0.000	10.724	0.532	0.469	0.420	0.029	0.610
YC3		5 yr	193	9.244	0.580	2.90	−7.348	0.000	9.771	0.422	1.099	0.321	−0.039	0.696
YC4		7 yr	193	6.345	0.631	3.42	−7.431	0.000	14.287	0.631	3.615	0.202	−0.119	0.757
YC5	10 bp	2 yr	193	4.847	0.540	2.76	−6.878	0.000	10.056	0.569	0.902	0.301	−0.059	0.648
YC6		3 yr	193	7.891	0.486	2.31	−6.365	0.000	11.558	0.591	1.172	0.337	0.014	0.583
YC7		5 yr	193	7.794	0.615	3.29	−8.307	0.000	11.464	0.592	2.366	0.212	−0.108	0.738
YC8		7 yr	193	4.546	0.437	2.46	−10.306	0.000	20.032	2.156	14.953	0.088	−0.158	0.524

Mortgage Arbitrage

- Strategy consists of buying MBS pass-throughs and hedging their interest rate exposure with swaps
- Main risk is prepayment risk
- Prepayment option embedded generates negative convexity
- Long positions are financed by repurchase agreements called dollar roll (dealer can deliver a different pool of mortgages)

Table 3

Summary Statistics for the Mortgage Arbitrage Strategy. This table reports the indicated summary statistics for the monthly percentage excess returns from the mortgage arbitrage strategy. Mortgage denotes the type of mortgage backed securities used in the strategy—discount, par, or premium. N denotes the number of monthly excess returns. Capital is the initial amount of capital required per \$100 notional of the arbitrage strategy to give a ten-percent annualized standard deviation of excess returns. The t-statistics for the means are corrected for the serial correlation of excess returns. Ratio Neg. is the proportion of negative excess returns. The sample period for the strategy is December 1996 to December 2004.

Strategy	Mortgage	N	Capital	Mean	t-Stat	Min.	Med.	Max.	Skew.	Kurt.	Ratio Neg.	Serial Corr.	Sharpe Ratio
MA1	Discount	97	21.724	0.691	2.08	−6.794	0.592	11.683	0.882	2.929	0.383	0.128	0.830
MA2	Par	97	19.779	0.466	1.50	−7.600	0.478	11.676	0.330	2.263	0.402	0.059	0.560
MA3	Premium	97	16.910	0.065	0.23	−8.274	0.311	9.844	−0.274	1.452	0.402	−0.052	0.078

Fixed Income Volatility Arbitrage

- Volatility arbitrage is often implemented by selling options and delta-hedging the exposure to the underlying asset
- Expected profit if implied volatilities exceed subsequent realised volatilities
- Selling options produces an excess return proportional to the gamma of the option times the difference between the implied variance and the realized variance

Table 4

Summary Statistics for the Fixed Income Volatility Arbitrage Strategy. This table reports the indicated summary statistics for the monthly percentage excess returns from the fixed income volatility arbitrage strategy of shorting at-the-money interest rate caps of the indicated maturity. N denotes the number of monthly excess returns. Capital is the initial amount of capital required per $100 notional of the arbitrage strategy to give a ten-percent annualized standard deviation of excess returns. The t-statistics for the means are corrected for the serial correlation of excess returns. Ratio Neg. is the proportion of negative excess returns. The sample period for the strategy is October 1989 to December 2004 (but is shorter for some strategies because cap volatility data for earlier periods are unavailable).

Strategy	Position	Cap	N	Capital	Mean	t-Stat	Min.	Med.	Max.	Skew.	Kurt.	Ratio Neg.	Serial Corr.	Sharpe Ratio
VA1	Short	1 yr	183	0.463	0.268	0.78	−9.833	0.448	7.745	−0.950	1.488	0.383	0.465	0.332
VA2		2 yr	183	0.734	0.389	1.11	−9.720	0.893	6.550	−0.962	1.579	0.383	0.465	0.467
VA3		3 yr	183	0.863	0.609	1.77	−9.675	1.092	6.851	−0.909	1.332	0.355	0.445	0.731
VA4		4 yr	183	0.953	0.682	2.08	−10.295	1.106	7.087	−0.989	1.644	0.311	0.409	0.819
VA5		5 yr	150	1.082	0.488	1.32	−9.997	0.912	6.654	−0.988	1.772	0.347	0.423	0.586
VA6		7 yr	135	1.279	0.270	0.72	−10.513	0.919	5.811	−1.221	2.331	0.393	0.398	0.324
VA7		10 yr	132	1.474	−0.068	−0.19	−12.819	0.400	5.072	−1.487	3.501	0.417	0.362	−0.082

Capital Structure Arbitrage

- Capital structure arbitrage/credit arbitrage exploits mis-pricing between a company's debt and its other securities (e.g. equity)
- Calculate theoretical CDS spread & size of equity position to hedge changes in CDS value
- Compare theoretical CDS spread with the market quoted level
- If the market spread is higher, short the CDS contract maintaining equity hedge
- Strategy profitable when spreads converge to each other

Table 5

Summary Statistics for the Capital Structure Arbitrage Strategy. This table reports the indicated summary statistics for the monthly percentage excess returns from the capital structure arbitrage strategy. Rating denotes whether the strategy is applied to investment-grade or speculative-grade CDS obligors. Trigger denotes the ratio of the difference between the market spread and the model spread divided by the model spread, above which the strategy is implemented. N denotes the number of monthly excess returns. Capital is the initial amount of capital required per $100 notional of the arbitrage strategy to give a ten-percent annualized standard deviation of excess returns. The t-statistics for the means are corrected for the serial correlation of excess returns. Ratio Neg. is the proportion of negative excess returns. The sample period for the strategy is January 2001 to December 2004.

Strategy	Rating	Trigger	N	Capital	Mean	t-Stat	Min.	Med.	Max.	Skew.	Kurt.	Ratio Neg.	Serial Corr.	Sharpe Ratio
CS1	Invst.	1.00	48	47.000	0.768	1.95	−8.160	0.285	10.570	0.223	5.337	0.271	−0.055	0.922
CS2		1.50	48	52.300	0.613	1.25	−8.020	0.053	12.770	0.266	8.682	0.375	0.162	0.735
CS3		2.00	48	44.900	0.731	1.30	−4.640	0.000	13.790	0.342	10.075	0.417	0.296	0.877
CS4	Spec.	1.00	48	86.900	0.709	2.30	−8.680	0.000	7.680	0.331	2.646	0.167	−0.298	0.851
CS5		1.50	48	90.500	0.669	2.17	−7.250	0.000	10.920	0.358	4.661	0.146	−0.306	0.802
CS6		2.00	48	75.900	0.740	1.03	−1.730	0.000	15.210	0.448	15.889	0.104	0.505	0.887

Fixed income arbitrage risk & return

- If the residual risk of the arbitrage strategies are correlated with market factors, then the excess returns may represent compensation for the underlying market risk
- Excess returns from the strategies were regressed on the excess returns on the equity and bond portfolios

Table 6

Regression Results. This table reports the indicated summary statistics for the regression of monthly percentage excess returns on the excess returns of the indicated equity and bond portfolios. Results for the CSFB and HFRI fixed income arbitrage hedge fund return indexes are also reported. R_M is the excess returns on the CRSP value-weighted portfolio. SMB, HML, and UMD are the Fama-French small-minus-big, high-minus-low, and up-minus-down market factors, respectively. R_S is the excess return on an S&P index of bank stocks. R_2, R_5, and R_{10} are the excess returns on the CRSP Fama portfolios of two-year, five-year, and ten-year Treasury bonds, respectively. R_I and R_B are the excess returns on Merrill Lynch indexes of A/BAA-rated industrial bonds and A/BAA-rated bank bonds, respectively. The sample periods for the indicated strategies are as reported in the earlier tables.

$$R_{it} = \alpha + \beta_1 R_{Mt} + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 UMD_t + \beta_5 R_{St} + \beta_6 R_{2t} + \beta_7 R_{5t} + \beta_8 R_{10t} + \beta_9 R_{It} + \beta_{10} R_{Bt} + \epsilon_t$$

| Strategy | Alpha | | | | | | t Statistics | | | | | | R^2 |
		Alpha	R_M	SMB	HML	UMD	R_S	R_2	R_5	R_{10}	R_I	R_B	
SS1	0.207	0.86	1.41	−0.41	0.38	0.61	−1.10	1.95	−1.02	−0.55	−0.48	2.70	0.094
SS2	0.257	1.08	1.84	−0.84	1.25	1.23	−2.20	0.40	−0.42	−1.28	0.68	2.75	0.118
SS3	0.111	0.49	1.80	−2.29	0.37	0.73	−1.83	1.55	0.14	−4.14	2.30	2.74	0.216
SS4	−0.189	−0.86	2.88	−1.77	1.65	2.23	−1.98	2.28	1.40	−5.63	2.28	2.11	0.250
SS5	−0.076	−0.33	1.57	0.46	0.51	0.66	−1.93	2.90	−2.24	0.96	−1.96	4.05	0.159
SS6	0.118	0.49	1.99	−0.79	0.90	0.79	−2.34	1.58	−1.69	0.11	−0.28	3.05	0.105
SS7	−0.068	−0.30	2.55	−1.79	1.09	1.34	−2.42	1.61	0.01	−3.88	1.92	3.14	0.225
SS8	−0.172	−0.78	2.79	−1.86	1.63	2.19	−1.94	1.99	1.28	−5.38	2.54	1.98	0.241
YC1	0.365	1.48	0.44	0.49	0.08	0.31	0.14	2.16	−0.62	0.69	−1.74	0.27	0.043
YC2	0.409	1.68	0.09	0.84	0.55	0.82	0.22	2.22	−0.07	0.04	−2.22	0.77	0.071
YC3	0.535	2.19	−0.47	1.38	0.71	0.76	0.57	1.35	−1.45	1.96	−2.58	1.57	0.068
YC4	0.818	3.38	−1.15	1.96	0.26	0.86	1.04	−0.37	−0.44	1.81	−2.32	0.26	0.089
YC5	0.582	2.36	−0.81	1.25	−0.25	−0.16	1.03	1.44	0.10	0.23	−1.86	0.27	0.057
YC6	0.521	2.14	−1.04	0.93	−0.22	−0.14	0.88	1.98	−0.09	−0.00	−2.02	0.76	0.075
YC7	0.638	2.64	−0.85	1.78	0.33	0.86	0.62	0.84	−1.57	2.28	−3.10	2.31	0.094
YC8	0.653	2.74	−0.48	−0.56	−0.07	0.21	−0.27	1.27	−1.33	1.11	−2.30	1.44	0.117
MA1	0.725	2.12	−1.42	−1.46	−1.33	−0.87	1.05	−0.74	−0.24	−0.39	2.52	−0.61	0.160
MA2	0.555	1.61	−1.64	−1.20	−1.68	−1.23	0.72	−0.23	−1.74	1.07	1.82	0.02	0.142
MA3	0.157	0.47	−2.08	−1.45	−1.61	−0.91	1.00	0.51	−2.68	1.18	2.41	−0.15	0.191

Table 6 Continued

| Strategy | Alpha | | | | | | t Statistics | | | | | | R^2 |
		Alpha	R_M	SMB	HML	UMD	R_S	R_2	R_5	R_{10}	R_I	R_B	
VA1	−0.062	−0.24	0.02	−0.07	0.35	0.76	−0.75	1.90	−0.99	−0.86	1.47	0.53	0.061
VA2	0.074	0.29	0.60	−0.71	0.39	0.92	−1.27	1.44	−0.78	−0.85	1.42	0.56	0.056
VA3	0.305	1.21	0.67	−1.29	0.22	0.93	−1.43	1.06	−1.01	−0.41	1.21	0.57	0.064
VA4	0.415	1.65	0.53	−1.56	0.03	0.95	−1.34	0.71	−0.93	−0.23	1.65	0.53	0.066
VA5	0.228	0.83	0.37	−1.59	0.06	1.09	−1.11	0.80	−0.97	−0.24	0.83	0.55	0.081
VA6	0.069	0.24	0.23	−1.87	−0.05	1.09	−0.99	0.42	−0.85	−0.02	1.22	0.21	0.098
VA7	−0.278	−0.97	0.36	−2.10	0.12	1.42	−1.02	0.19	−0.81	0.21	1.11	0.17	0.127
CS1	1.073	1.66	0.58	−1.94	0.55	−0.59	0.59	0.52	−1.04	1.05	−0.30	−0.12	0.252
CS2	0.803	1.34	1.55	−2.06	0.85	−0.32	−0.73	0.32	−1.01	0.96	0.66	−0.68	0.352
CS3	1.076	1.70	1.45	−1.78	0.50	−0.38	−1.64	0.11	−0.48	0.44	0.98	−0.91	0.280
CS4	0.432	0.69	−0.61	−0.71	−1.23	−0.53	0.38	−0.35	−0.40	−0.70	1.80	0.43	0.303
CS5	1.150	1.67	−1.47	−0.38	−1.64	−1.46	0.48	−1.08	−0.35	0.11	0.96	−0.11	0.149
CS6	1.235	1.95	−0.72	0.40	−0.50	−0.96	−1.36	−2.14	1.61	−1.03	2.50	−2.03	0.282
CSFB	0.412	3.87	−0.80	0.79	−0.09	0.71	0.32	1.06	−2.30	0.17	−0.06	2.69	0.159
HFRI	0.479	4.22	−1.70	0.73	−0.59	−0.44	0.81	0.20	0.84	−2.76	1.52	0.40	0.139

Arbitrage and hedge fund capital

- Too much capital can drive down the returns
- Intermediate levels of capital may improve liquidity & enable trades to converge more rapidly
- Profitability of arbitrage strategies are correlated with the capital devoted to arbitrage

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Table 7

Results from the Regression of Risk-Adjusted Returns on Changes in Aggregate Fixed Income Arbitrage Hedge Fund Capital. This table reports results from the regression of the risk-adjusted returns for the arbitrage strategies (the residuals from the regression in Table 6) on the change in the Tremont/TASS (2004) measure of total fixed income arbitrage hedge fund capital over the prior year. Results for the CSFP and HFRI fixed income arbitrage hedge fund return indexes are also reported. The table reports the estimated slope coefficient β_1 and its t-statistic, along with the R^2 of the regression.

$$\text{Res}_{st} = \beta_0 + \beta_1 \, \Delta \, \text{Capital}_t + e_{st}.$$

Strategy	Slope Coefficient	t-Statistic	R^2
SS1	−0.02765	−0.74	0.005
SS2	−0.04245	−1.08	0.010
SS3	−0.05442	−1.20	0.012
SS4	−0.06964	−1.40	0.017
SS5	−0.01686	−0.49	0.002
SS6	−0.03647	−0.91	0.007
SS7	−0.05395	−1.17	0.011
SS8	−0.07728	−1.53	0.020
YC1	0.02061	0.43	0.002
YC2	0.09093	1.83	0.028
YC3	0.11140	2.13	0.037
YC4	0.03317	0.61	0.003
YC5	−0.00309	−0.06	0.000
YC6	0.09812	1.97	0.032
YC7	0.01343	0.26	0.001
YC8	0.00887	0.16	0.000
MA1	0.15615	3.26	0.101
MA2	0.16879	3.52	0.116
MA3	0.10148	2.10	0.044
VA1	−0.04887	−0.95	0.008
VA2	−0.10111	−1.90	0.030
VA3	−0.13628	−2.56	0.053
VA4	−0.13923	−2.59	0.054
VA5	−0.13299	−2.69	0.054
VA6	−0.10814	−2.21	0.040
VA7	−0.08555	−1.76	0.026
CS1	−0.06655	−1.08	0.024
CS2	−0.08342	−1.46	0.044
CS3	−0.08987	−1.50	0.046
CS4	−0.06396	−1.07	0.024
CS5	−0.07963	−1.21	0.031
CS6	−0.11467	−1.87	0.071
CSFB	−0.01487	−0.79	0.005
HFRI	0.01298	0.63	0.003

Summary of Findings

- Strategies requiring more "intellectual capital" to implement tend to produce significant alphas after controlling for bond/equity risk factors
- Risk adjusted excess returns are related to capital flows into fixed income arbitrage hedge funds
- Many strategies produce positively skewed returns
- Evidence of more economic substance in fixed income arbitrage