

Who Invested In Amaranth? A Flash Analysis of Fund of Funds

George A. Martin

Associate Director, CISDM, University of Massachusetts, Amherst

Managing Director, Alternative Investment Analytics, LLC

First Version: November 24, 2006

This Version: January 4, 2007

Email: Martin@alternativeanalytics.com

DRAFT

NOT FOR CITATION OR QUOTATION
WITHOUT PERMISSION OF THE AUTHOR

Executive Summary

This study identifies 80 fund of funds that were significantly invested in Amaranth in September, 2006, utilizing direct or indirect, statistical methods. We find that such fund of funds investing in Amaranth were typically:

- 1) larger than non-investors;
- 2) more exposed to difficult-to-manage risk factors such credit and market implied volatility, and typical of large fund of funds that focus on ‘market neutral’ or ‘relative value’ strategies;
- 3) exhibiting higher sharpe ratios, and higher production of ‘alpha’ on a historical risk-adjusted basis (“standardized alpha”) than non-investors.

These characteristics of fund of funds--large, ‘low’ market exposure, high sharpe ratio—are typically characteristics that investors are advised to seek out when investing in fund of funds. That such fund of funds should be more likely to have been Amaranth investors, despite due diligence and other processes that fund of funds hold forth as reducing the likelihood exposure to massive risk taking such as was undertaken by Amaranth, should raise questions about these investing bromides.

As a result of their exposure to Amaranth, fund of funds with significant investments in Amaranth:

- 1) Gave up an estimated median of 4% in September, 2006, reflecting a corresponding median allocation of 6% of fund assets to Amaranth;
- 2) Lost an average of 19.2M dollars; and,
- 3) Gave up an estimated median of 2.1 and an average of 5.7 years of their total alpha production.

A quantitative model that attempts to predict allocations to Amaranth based on quantitative risk and exposure characteristics suggests that while certain exposure characteristics, as given above, are associated with investments in Amaranth, nevertheless among all funds that exhibit a subset of such characteristics, it is difficult to explain quantitatively the choice to invest based on portfolio or risk considerations. This suggests that the important determinant in the choice to invest was some explanator uncorrelated with portfolio or risk considerations, such as the quality, or lack thereof, of the due diligence process.

Investors in fund of funds should consider this a lesson in the importance of evaluating the overall investment processes of such fund of funds, and accordingly evaluate whether the value of all services provided by candidate fund of funds match or exceeds the value of expected fees.

Introduction

Throughout the last half of the month of September, investors and other participants in the hedge fund industry watched as Amaranth Advisors' Multi-Strategy Funds suffered extraordinary losses of approximately 65% of capital on bad bets on natural gas and other assets. With such losses has come the unsurprising round of recriminations about how investors should have anticipated such risks, especially given readily available information about the volatility and changing nature of investments by the Amaranth Multi-Strategy Funds.

While there are many reasons to believe that such risks were evident to potential direct investors in Amaranth, a substantial amount of investment in Amaranth was made via hedge fund of funds—specifically, we have identified fund of funds compromising approximately 26% of the total investment in its funds. Investors in fund of hedge funds invest in such funds in part because such funds hold themselves out as capable, through due diligence or other monitoring mechanisms, of avoiding such blow-ups. Nevertheless, investors themselves must choose the fund of funds through which they invest. The obvious question arises – were there any common characteristics to the fund of funds with substantial investments in Amaranth that could serve as warning signals to investors regarding current or future investment strategies pursued by such funds of funds?

Methodology—Identifying Investors in Amaranth

Using a proprietary database of fund of funds, we select those fund of funds with estimated management company AUM of greater than USD100M, a two year track record, and a loss in September 2006 of more than (2.6 standard deviations + one month Ret on 3M Libor), with standard deviations estimated from the most recent 2 years worth of data prior to September, 2006. From the 1108 funds meeting AUM and track record constraints with complete and up to date information, we identify 80 funds that meet this loss criteria, or have been reported in the press or elsewhere as having been Amaranth investors.¹ Based on our estimates, we have captured fund of funds with losses 1.5B dollars on 2.4B of the estimated 10B in Amaranth assets. Our universe of fund of funds with all necessary data for this study has an estimated AUM of 296B, with approximately 44B, or 15%, of assets in fund of funds identified as Amaranth investors. While we

¹ Using the 2.6 stdev criteria, we would expect, under the assumption of normality, that approximately 5 funds would be incorrectly identified as having an Amaranth investment. More specifically, we have 1108 funds to be classified. The probability of misclassifying any individual fund, assuming an expected fund return of 3M Libor, is equal to $1 - \Phi(2.6)$ where $\Phi()$ represents the standard cumulative Normal distribution. The total number of misclassifications is therefore binomially distributed with trial success probability equal to the misclassification probability of an individual fund.

Of course, our criteria does not capture fund of funds with very small, but positive, relative allocations to Amaranth. We assume that such small allocations were by design, and, by imputation, represented a better appreciation of the risk associated with making such an investment.

In general our statistical approach identifies funds that have been identified in the press. However, we do not include all funds that have been identified in the press, as we may either lack September returns or some other necessary information to conduct our analysis.

believe that this is a significant underestimate of the total dollars invested by FOF in Amaranth, and FOF more generally, we have no reason to believe that our undercounting is biased towards or against specific fund of fund characteristics.²

We can see that the bulk of losses due to Amaranth were, on a dollar basis, relatively small, though there were a small number of large losses:

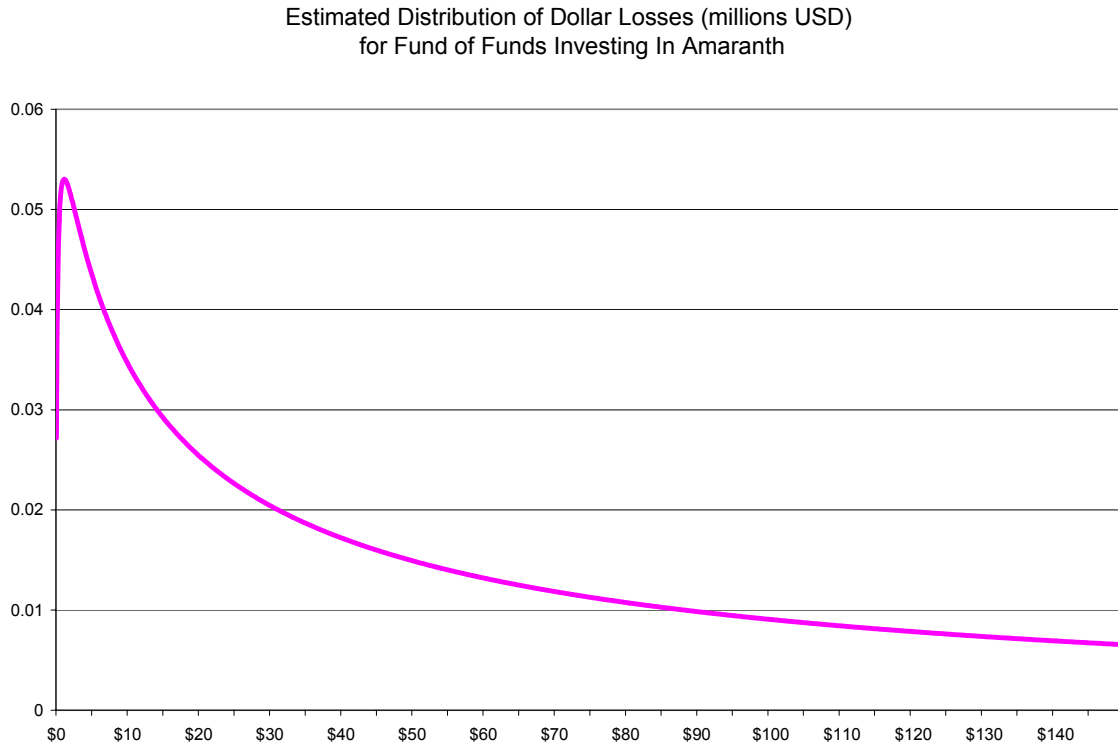


Figure 1a: Distribution of Dollar Losses to Amaranth

² One estimate available in the press is that fund of funds contributed up to 60% of Amaranth assets. “All talk, no action so far for Amaranth investors,” Pensions and Investments, October 2, 2006.

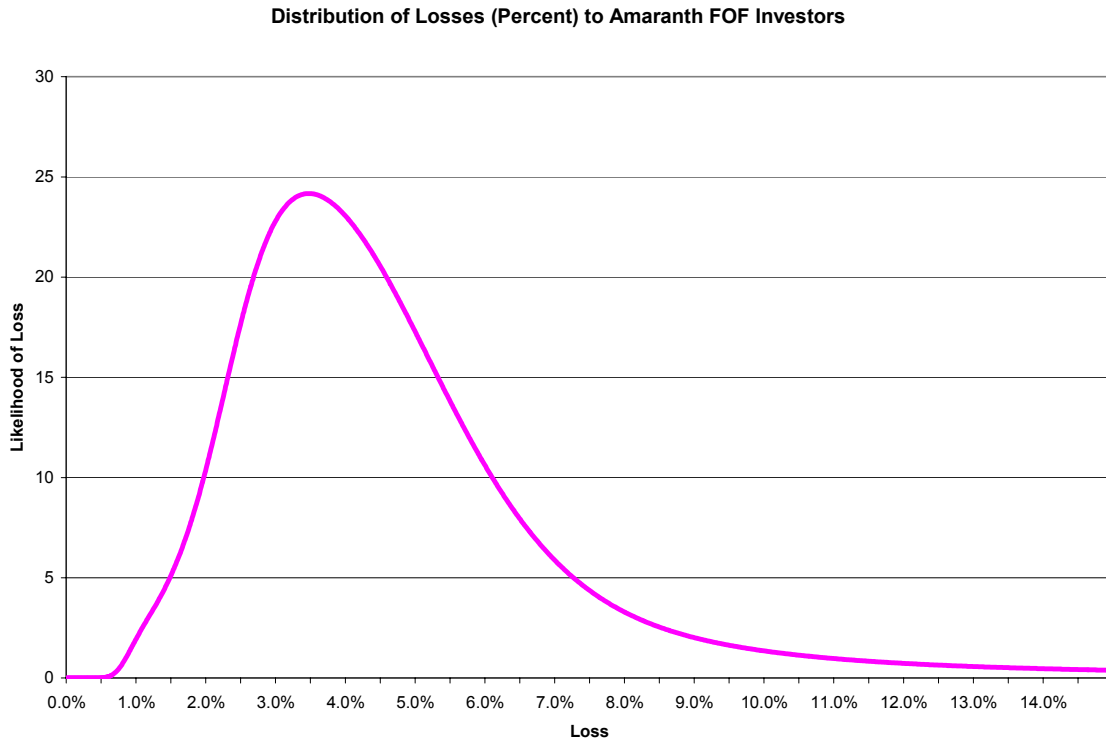


Figure 1b: Distribution of Percent Losses to FOF's due to Amaranth

This distribution of losses reflects both the distribution of Amaranth investors among large and small funds as well as the varying proportion of the fund allocated to Amaranth by each manager.

Comparing losses purely on a return basis, we see that the typical fund lost approximately 4%, meaning an average allocation to Amaranth of approximately 6%:

Distribution of Returns for Fund of Funds in Sept 2006

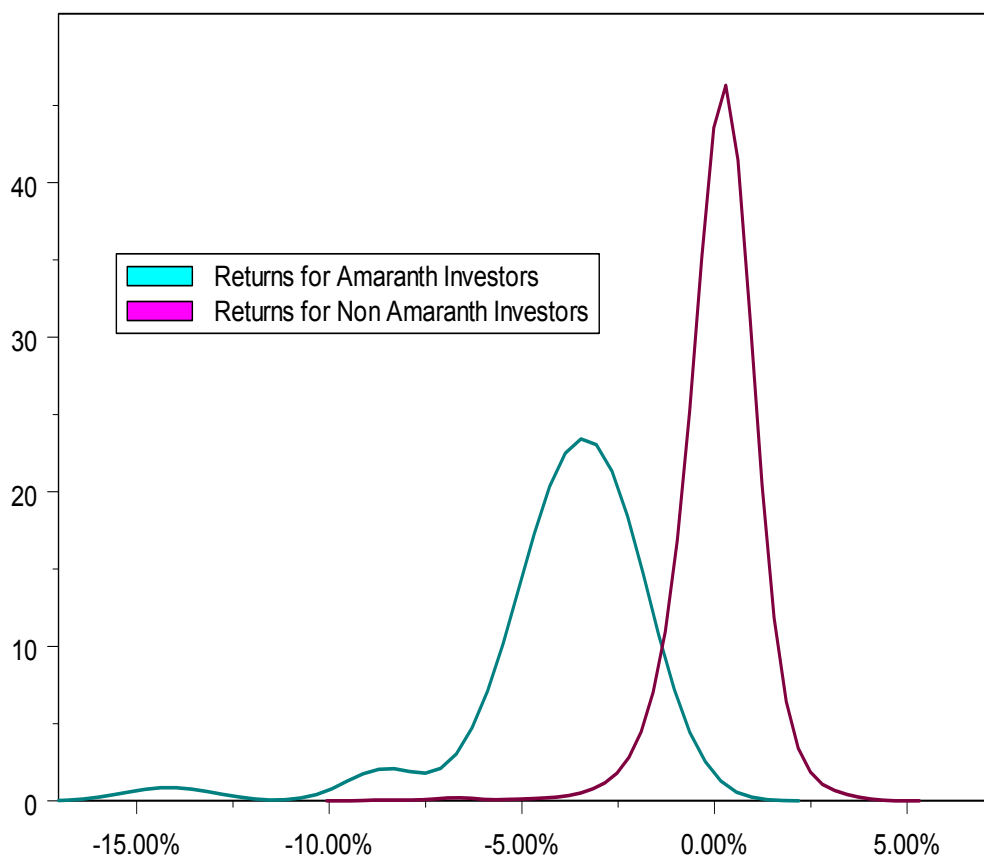


Figure 2: Density of Sept 2006 Returns: Amaranth vs. Non-Amaranth

Additionally, we can estimate the cost to investors of having invested in a fund of funds that invested in Amaranth in terms of the amount of alpha the fund of funds gave back by the loss. To that end, we estimate the alpha of each fund of fund versus Russell 2000, Lehman Government, Lehman Corporate High Yield, and the VIX, and compare it with the corresponding multifactor forecast of Sept 2006 returns. On average, the fund of funds investing in Amaranth lost 5.7 years worth of their alpha in the month of September, with the median fund of fund losing 2.1 years of alpha. This suggests that losses such as those associated with Amaranth represent a significant factor for consideration of the investor in fund of funds.

In general, it is also worth noting that fund of funds investing in Amaranth tended to be larger than non-Investors, with the median fund sizes for non-investing fund of funds being \$82M vs. \$260M for investing fund of funds; reflecting the skewed distribution in FOF AUMs, it is not surprising that the corresponding *average* numbers are much larger, at \$245M vs. \$546M.

Estimated Distribution of Years of Lost Alpha to Amaranth FOF Investors

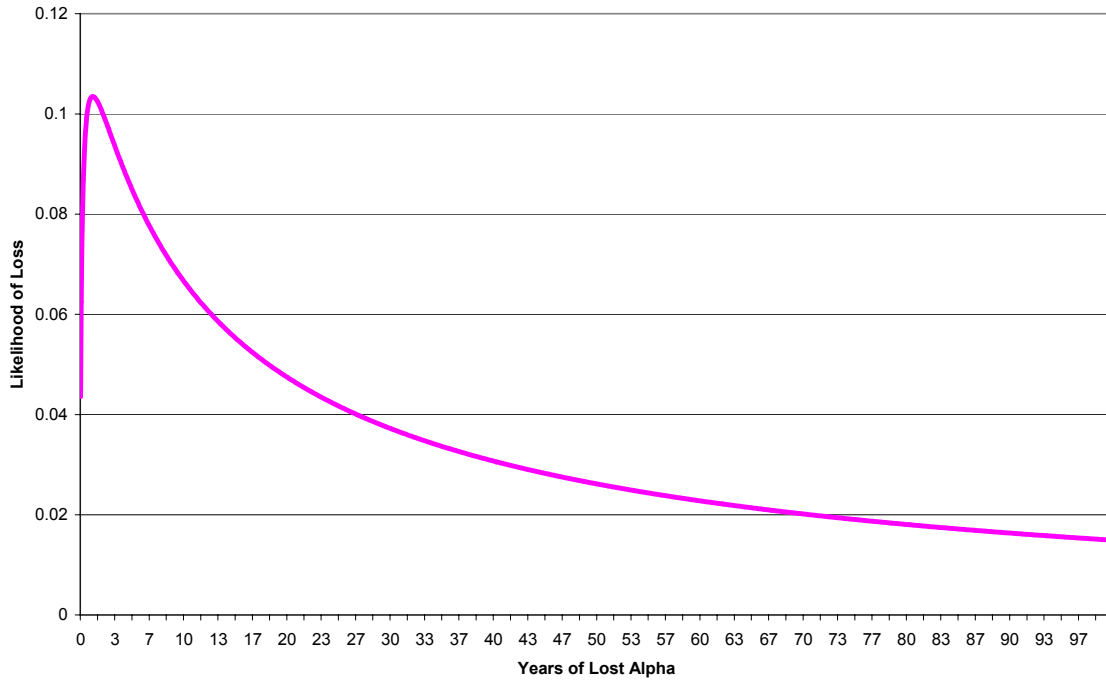


Figure 3: Distribution of Estimated Years of FOF Alpha Lost Due to Amaranth Investments

**Distribution of Fund AUM (USD Billions)
Amaranth Investors vs. Non-Investors**

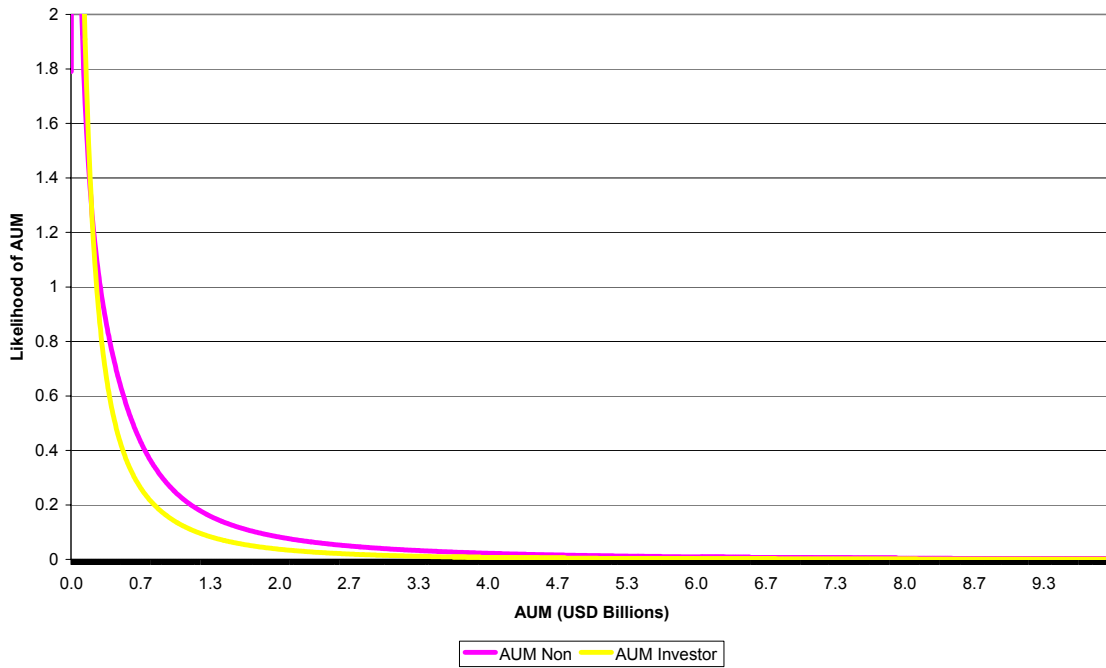


Figure 4: Distribution of Fund of Fund Assets Under Management (AUM)

Characteristics of Amaranth Investors

We can investigate the characteristics of fund of funds in our universe that turned out to be Amaranth investors and compare them to those that don't. Our basic technique is to estimate quantitative statistics of each fund of funds during the 2 years (9/04-8/06) preceding the blowup. We estimate: 1) average fund of fund return; 2) standard deviation of fund of fund returns; 3) sharpe ratio (vs. 3 month Libor); the alpha and beta coefficients from a multifactor regression of excess fund of fund returns on four factors 4) Russell 2000; 5) Leh US Gov; 6) Excess Return of Lehman HY Corp to Leh US Gov; 7) VIX; 8) Alpha; 9) R2 of that multifactor regression; 10) log of Assets under Management; 11) Rank of fund of fund alpha (in quartiles:0,1,2, and 3) versus others in universe, with 0 being the best; and 12) Standardized Alpha = alpha/standard deviation of corresponding fund of fund returns. Note, generally, unless otherwise indicated, that whenever we used variables that are ranks, 0 represents the 'best'.

Stratification is based on AMARANTH					
Variable	Mean	Std.Dev.	Minimum	Maximum	Cases

Stratum is AMARANTH =	NO	Obs.=	1028.000,	Sum of wts. =	1028.000

AMARANTH	.000000000	.000000000	.000000000	.000000000	1028
R2000	-.540424510E-01	.139147849	-.965013560	1.15087249	1028
LEHUS	.190478474	.264447019	-.809159162	1.89409490	1028
LEHCORP	.455518526E-02	.251361398	-1.25799338	2.36596768	1028
VIX	.164387126	.128623958	-.390586888	1.31659063	1028
ALPHA	.162603211E-02	.289493133E-02	-.171355648E-01	.200345826E-01	1028
R2	.484645941	.158427295	.460918565E-01	.974236755	1028
AVERAGER	.408598057E-02	.341042112E-02	-.708777585E-02	.274301408E-01	1028
STDEV	.155420512E-01	.818565590E-02	.258036398E-02	.661708227E-01	1028
STDALPHA	.383329125	.686840274	-2.03267451	6.86963921	1028
SHARPE	.940551540	.666275433	-1.57601742	6.77173864	1028
LOGAUM	7.91390165	.645588242	7.00000000	9.84509804	1028
ALPHARAN	1.48151751	1.13741744	.000000000	3.00000000	1028

Stratum is AMARANTH =	YES	Obs.=	80.000,	Sum of wts. =	80.000

AMARANTH	1.000000000	.000000000	1.000000000	1.000000000	80
R2000	-.451970684E-01	.372555786E-01	-.126633371	.522799017E-01	80
LEHUS	.142995096	.981153275E-01	-.203165925	.376664137	80
LEHCORP	-.122267072	.125935920	-.617539704	.939034057E-01	80
VIX	.106238960	.827438869E-01	-.123942393E-01	.517450842	80
ALPHA	.109506053E-02	.127334414E-02	-.216496790E-02	.598808383E-02	80
R2	.473535919	.978208711E-01	.194299871	.688924329	80
AVERAGER	.291938046E-02	.147061338E-02	.331807486E-03	.990680749E-02	80
STDEV	.106507782E-01	.523556656E-02	.413088987E-02	.372077266E-01	80
STDALPHA	.441380591	.530326339	-.510069327	2.66449356	80
SHARPE	1.03305629	.514945405	.102953398	3.01581955	80
LOGAUM	8.33491281	.633373848	7.00000000	9.70693104	80
ALPHARAN	1.73750000	.807304469	.000000000	3.00000000	80

All observations in current sample					

AMARANTH	.722021661E-01	.258939235	.000000000	1.000000000	1108
R2000	-.534037952E-01	.134414179	-.965013560	1.15087249	1108
LEHUS	.187050071	.256352444	-.809159162	1.89409490	1108
LEHCORP	-.460165641E-02	.246630806	-1.25799338	2.36596768	1108
VIX	.160188702	.126743158	-.390586888	1.31659063	1108
ALPHA	.158769481E-02	.281240017E-02	-.171355648E-01	.200345826E-01	1108
R2	.483843774	.154843492	.460918565E-01	.974236755	1108
AVERAGER	.400174951E-02	.332205101E-02	-.708777585E-02	.274301408E-01	1108
STDEV	.151888907E-01	.810697168E-02	.258036398E-02	.661708227E-01	1108
STDALPHA	.387520566	.676723180	-2.03267451	6.86963921	1108
SHARPE	.947230584	.656764089	-1.57601742	6.77173864	1108
LOGAUM	7.94429956	.653588100	7.00000000	9.84509804	1108
ALPHARAN	1.50000000	1.11853886	.000000000	3.00000000	1108

We can see from the data, that Amaranth investors tended to come from higher sharpe ratio, lower volatility funds, as would be typical of a fund of funds specializing in relative value funds. Amaranth investors also tend to be more negatively exposed to credit risk, as proxied by fund beta versus the return differential between Lehman Corp HY and Leh Government. Overall, Amaranth investors tended to be generating *less* alpha in the time period leading up to the blowup, but this largely a function of the fact that Amaranth investors tended to have lower overall volatility. If we look at amount of alpha generated per unit of fund volatility (“standardized alpha” or STDALPHA), we see that Amaranth investors were generating more alpha per unit of realized risk. We also see, that on average, Amaranth investors were larger than non-investors. From this simple analysis, we see that reliance on the simple nostrums of investing with the largest, historically most efficient producers of alpha, may lead to substantially negative outcomes.³

Quantitative Prediction of Due Diligence and Risk Management Failures

The obvious question arises: given the average differences between Amaranth and non-Amaranth investors, is it possible to be more specific and identify which characteristics are most helpful in identifying fund of funds that were more likely to have been invested in Amaranth, or the converse--identifying characteristics that make it less likely that a FOF will have been invested in Amaranth?

To answer this question we formulate a *probit* model:

$$\Pr(Y = 1) = \Phi(\beta'x)$$

Where: 1) $Y=1$ represents that the FOF had an investment in Amaranth; 2) β is a vector of coefficients to be estimated; 3) x is an array of ones (to estimate a constant) and characteristics, such as Sharpe, $\log(\text{AUM})$, etc. and 4) $\Phi(\)$ is the cumulative normal distribution. Note that, because the dependent variable is a nonlinear function of $\beta'x$, we cannot interpret these beta's as the usual marginal effects of a linear regression. Instead, we estimate marginal effects as $\partial E[Y|x]/\partial x$, evaluated at the mean of x .

For the full model we have the following results:

³ This phenomenon is related to the problem of ‘pseudo-alpha’ that the author has explored in other papers and presentations. The term, which we find quite apt, was coined by Nassim Taleb.

Probit Model (1=Amaranth Investor)					
Variable	Coefficient	Standard Error	b/St.Er.	P[Z >z]	Mean of X
Index function for probability					
Constant	-6.60170613	.90733461	-7.276	.0000	
R2000	-1.50885263	.73446503	-2.054	.0399	-.05340380
LEHUS	-.08125909	.31199902	-.260	.7945	.18705007
LEHCORP	-2.01874529	.40579460	-4.975	.0000	-.00460166
VIX	-2.58984769	.67134739	-3.858	.0001	.16018870
ALPHA	-213.467409	52.7222352	-4.049	.0001	.00158769
SHARPE	.51780583	.14961531	3.461	.0005	.94723058
LOGAUM	.62256459	.10830863	5.748	.0000	7.94429956
Marginal Effects					
Variable	Coefficient	Standard Error	b/St.Er.	P[Z >z]	Elasticity
Index function for probability					
Constant	-.48060763	.07647756	-6.284	.0000	
R2000	-.10984525	.05284580	-2.079	.0377	.18019202
LEHUS	-.00591570	.02273029	-.260	.7947	-.03398963
LEHCORP	-.14696571	.02841596	-5.172	.0000	.02077363
VIX	-.18854226	.04752470	-3.967	.0001	-.92773236
ALPHA	-15.5405382	3.72490230	-4.172	.0000	-.75790575
SHARPE	.03769653	.01102401	3.419	.0006	1.09682980
LOGAUM	.04532303	.00830088	5.460	.0000	11.0600382

We can see from the model that most factors are significant, except sensitivity of the fund of funds to changes in the value of US government bonds. We see that the higher the fund of funds' sharpe ratio and the larger its AUM, the more likely was exposure to Amaranth. Similarly, the larger the fund of funds exposure to credit, or the shorter it was of implied volatility, the more likely it was to hold Amaranth. The regression also indicates that the lower the fund of fund's alpha, the more likely exposure to Amaranth. However, we shall see that the story around fund of fund alpha is far more subtle.

We can look at the raw results of the models' predictions in order to get a better sense of the effectivity of the model. We see that the model is extremely good at predicting which fund of funds should *not* have exposure to Amaranth—having an accuracy of 92%. However, we see that the model does not do such a good job of predicting which funds *do* have exposure.

Frequencies of actual & predicted outcomes
 Predicted outcome has maximum probability.
 Threshold value for predicting Y=1 = .5000

		Predicted		
		0	1	
Actual	0	1024	4	Total
	1	80	0	
Total		1104	4	1108

Essentially, what this implies is that fund of funds investing in Amaranth have a set of characteristics that are unlike most other fund of funds, but that there are also other fund of funds that did not invest in Amaranth which are similar to those that did, and the model can't simultaneously discriminate between those that very different and those that are very similar. We can evaluate this more directly by attempting to sort the universe of fund of funds in such a manner as to gather as many of those fund of funds that are like those that invested in Amaranth, and then estimating a prediction model only on those similar funds.

To implement this, we sort funds of funds by the amount of standardized alpha that they delivered over the two years prior to September, 2006.

Descriptive Statistics
 All results based on nonmissing observations.
 Stratification is based on SARANK

Variable	Mean	Std.Dev.	Minimum	Maximum	Cases
Stratum is SARANK = .000. Obs.= 277.000, Sum of wts. = 277.000					
AMARANTH	.541516245E-01	.226726273	.000000000	1.000000000	277
R2000	-.573142177E-01	.139544233	-.965013560	.305934223	277
LEHUS	.197419588	.263617050	-.693405375	1.38122675	277
LEHCORP	.420182625E-01	.278342508	-1.25799338	2.36596768	277
VIX	.133019083	.965604617E-01	-.135234416	.601303163	277
ALPHA	.437262248E-02	.274002018E-02	.813453395E-03	.200345826E-01	277
R2	.458846096	.163518932	.570631748E-01	.840920033	277
AVERAGER	.650541593E-02	.364343674E-02	.133180749E-02	.274301408E-01	277
STDEV	.140608152E-01	.818691668E-02	.258036398E-02	.552119517E-01	277
STDALPHA	1.17976788	.641538393	.712237222	6.86963921	277
SHARPE	1.70580866	.561502889	.570424443	6.77173864	277
LOGAUM	8.12943319	.650406582	7.00000000	9.60205999	277
ALPHARAN	.339350181	.531953888	.000000000	2.00000000	277
SARANK	.000000000	.000000000	.000000000	.000000000	277
Stratum is SARANK = 1.000. Obs.= 277.000, Sum of wts. = 277.000					
AMARANTH	.974729242E-01	.297137497	.000000000	1.000000000	277
R2000	-.739261948E-01	.140907634	-.594445949	.935477770	277
LEHUS	.197223594	.219629345	-.604673393	1.24777393	277
LEHCORP	.245400384E-01	.232992912	-1.07389065	.973087272	277
VIX	.167737901	.102761252	-.938748009E-01	.790028893	277
ALPHA	.254270040E-02	.133432561E-02	.671061555E-03	.112671562E-01	277
R2	.479303171	.149203040	.608568538E-01	.827501795	277
AVERAGER	.506445536E-02	.237175437E-02	.147764082E-02	.188526408E-01	277
STDEV	.161812421E-01	.770450770E-02	.417525965E-02	.578490231E-01	277
STDALPHA	.544878956	.915381442E-01	.388855821	.712182800	277
SHARPE	1.10440980	.162422832	.324016132	1.46182839	277
LOGAUM	8.06945131	.708949468	7.00000000	9.84509804	277
ALPHARAN	.866425993	.648459048	.000000000	2.00000000	277
SARANK	1.000000000	.000000000	1.000000000	1.000000000	277
Stratum is SARANK = 2.000. Obs.= 277.000, Sum of wts. = 277.000					
AMARANTH	.866425993E-01	.281819770	.000000000	1.000000000	277
R2000	-.569780760E-01	.123140651	-.443108631	.692879549	277
LEHUS	.207650573	.295964239	-.809159162	1.89409490	277
LEHCORP	-.127315578E-01	.222530357	-.696456560	.882220931	277
VIX	.173332483	.156362592	-.390586888	1.10245535	277
ALPHA	.911203864E-03	.746333238E-03	-.200284754E-04	.520657637E-02	277
R2	.505686719	.152664441	.460918565E-01	.974236755	277
AVERAGER	.355180275E-02	.223746091E-02	-.275985918E-02	.152609742E-01	277
STDEV	.161948108E-01	.882625639E-02	.413088987E-02	.597343681E-01	277
STDALPHA	.197339354	.114113855	-.279432184E-02	.386776039	277
SHARPE	.772100969	.218561231	-.400862682	1.16816628	277
LOGAUM	7.87622290	.602447003	7.00000000	9.23993631	277
ALPHARAN	1.79783394	.468882036	.000000000	3.00000000	277
SARANK	2.000000000	.000000000	2.000000000	2.000000000	277
Stratum is SARANK = 3.000. Obs.= 277.000, Sum of wts. = 277.000					
AMARANTH	.505415162E-01	.219456004	.000000000	1.000000000	277
R2000	-.253966923E-01	.129366884	-.440515507	1.15087249	277
LEHUS	.145906529	.236470186	-.628470725	1.23831400	277
LEHCORP	-.722333688E-01	.234515687	-.766911661	.873063122	277
VIX	.166665342	.138774023	-.130817220	1.31659063	277
ALPHA	-.147574750E-02	.181713004E-02	-.171355648E-01	-.947536078E-05	277
R2	.491539110	.150579238	.653990577E-01	.907345374	277
AVERAGER	.885324014E-03	.172713416E-02	-.708777585E-02	.602764082E-02	277
STDEV	.143186947E-01	.743488222E-02	.371849885E-02	.661708227E-01	277
STDALPHA	-.371903922	.365958638	-2.03267451	-.359776139E-02	277
SHARPE	.206602906	.396220037	-1.57601742	.737962296	277
LOGAUM	7.70209086	.557785979	7.00000000	9.17638069	277
ALPHARAN	2.99638989	.600841768E-01	2.00000000	3.00000000	277
SARANK	3.000000000	.000000000	3.000000000	3.000000000	277

We can see that fund of funds that invested in Amaranth are most likely to associated with fund of funds in the 2nd quartile of standardized alpha. We can therefore estimate our

probit model on the subset of fund of funds in that second quartile. The results are not particularly encouraging:

Probit Model for SARANK =1					
Variable	Coefficient	Standard Error	b/St.Er.	P[Z >z]	Mean of X
Index function for probability					
Constant	-7.74194324	2.32411845	-3.331	.0009	
R2000	-11.7112144	3.27073266	-3.581	.0003	-.07392619
LEHUS	.28080905	1.31098455	.214	.8304	.19722359
LEHCORP	-5.74520900	1.60468021	-3.580	.0003	.02454004
VIX	-4.20227852	3.38491114	-1.241	.2144	.16773790
ALPHA	-1855.96653	438.717248	-4.230	.0000	.00254270
SHARPE	3.97128232	1.43995400	2.758	.0058	1.10440980
LOGAUM	.58420194	.21330128	2.739	.0062	8.06945131
Marginal Effects for Probit Model for SARANK =1					
Variable	Coefficient	Standard Error	b/St.Er.	P[Z >z]	Elasticity
Index function for probability					
Constant	-.01397813	.02109382	-.663	.5075	
R2000	-.02114468	.03070472	-.689	.4910	3.07335703
LEHUS	.00050700	.00253576	.200	.8415	.19659963
LEHCORP	-.01037302	.01516209	-.684	.4939	-.50048815
VIX	-.00758724	.01281296	-.592	.5537	-2.50223888
ALPHA	-3.35096067	4.88163508	-.686	.4924	-16.7524396
SHARPE	.00717018	.01056685	.679	.4974	15.5694669
LOGAUM	.00105478	.00162340	.650	.5159	16.7347695

Prediction Results

Frequencies of actual & predicted outcomes
 Predicted outcome has maximum probability.
 Threshold value for predicting Y=1 = .5000

Predicted			
Actual	0	1	Total
0	244	6	250
1	18	9	27
Total	262	15	277

We see that only 33% of the fund of funds that invested in Amaranth are correctly identified by the model.

Thus we can see that it is difficult to fully discriminate between those fund of funds that were uniquely invested in Amaranth and those that were not, *suggesting that factors uncorrelated with risk and portfolio characteristics were significant determinants in the*

decision to invest in Amaranth. These uncorrelated factors might be the quality of due diligence process, the nature of a particular fund of fund's capacity constraints, etc.

Furthermore, this does not mean that investors in fund of funds should not be concerned about other potential, but unrealized, sources of extreme loss (e.g. credit) in other fund of funds that had similar profiles as those that were invested in Amaranth. As a generality, many of these fund of funds exhibit the investment strategy, intentional or not, of investing in risk exposures that are generally expected to generate modest positive returns, but at the risk of infrequent, but substantial negative returns.

Conclusion

Using imputed identification of fund of funds that were invested in Amaranth, we quantify the substantial loss to investors in such fund of funds. It is clear that such losses represent a substantial multiple of the ostensible value-added of such fund of funds. We see that such fund of funds that were most likely to invest in Amaranth were large, low volatility, high historic sharpe ratio, high credit risk funds, generating high alpha per unit of realized volatility ("standardized alpha"). However, not all such funds with these characteristics were Amaranth investors, and our quantitative model fails to accurately identify which funds of funds with these characteristics are those that ultimately were Amaranth investors, suggesting that the key determinant in the Amaranth investment decision is a factor uncorrelated with portfolio or risk characteristics, such as (quality of) due diligence or need to park large quantities of FOF aum. Thus, while the model can help us identify those fund of fund characteristics that are unlikely to be associated with investments in funds like Amaranth, it also suggests that qualitative due diligence on fund of funds is no less important in discriminating between those funds of funds with high risk characteristics that ultimately are exposed to blow-up risk from those that are actually delivering alpha and less exposed to such blow-up risk.