Short-put exposures in hedge fund returns: Are they really there?*

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Abstract

Existing literature suggests that systematic risk in hedge fund returns is partly captured by short positions in put option returns. We analyze whether equity option-exposures are actually there, and find they are not. In a sample of 13 hedge fund indices for the period 1994-2007, a few indices have a short exposure to short put-returns on the S&P 500, but the loadings are not robust over subperiods. Furthermore, the loadings are not consistent with basic properties of options, such as put-call parity and the relation between option prices and volatility.

Keywords: hedge funds, nonlinear systematic risk factors, option factors.

1 Introduction

This paper is about the use of factor models to estimate the systematic risks of hedge fund returns. This is relevant to assess the excess performance of hedge funds, as well as the implicit risks that investors in hedge funds are exposed to. Factor models work

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well for traditional mutual funds, see Sharpe (1992). However, in contrast with mutual funds, hedge funds have fast changing exposures, dynamic strategies as well as market-neutral strategies. These phenomena imply that a factor model that includes returns on traditional asset classes such as stocks and bonds, perform poorly, see Fung and Hsieh (1997). As such, the current literature assumes that hedge fund return patterns are badly captured by a linear factor model. Nonlinear exposures, such as the return on an option contract might be better suited to model hedge fund returns. Such exposures might follow from specific dynamic strategies such as market timing (Fung and Hsieh (2001)) or merger arbitrage (Mitchell and Pulvino (2001)). The latter suggests that the return to a short put option position can explain hedge fund return variation, which is corroborated by Agarwal and Naik (2004). Agarwal and Naik make the case that short put returns are ubiquitous in hedge fund return, or at least cited as such, see Driessen et al. (2006). In this paper, we backtest the conventional wisdom that short put returns on S&P 500 index options have explanatory power.

The short put exposure of hedge funds is lent credibility by theories on market timing and informationless investing. Merton (1981) argues that trend followers (as an example of a dynamic strategy) have return patterns that mimic those of a long straddle. Based on these arguments, Fung and Hsieh (2002, 2004) introduce returns on (lookback) straddles on bond futures, currency futures, and commodity futures as additional risk factors in style regressions for hedge fund returns. Also Mitchell and Pulvino (2001) and Agarwal and Naik (2004) use option returns to capture the dynamic nature of particular hedge fund styles. Another reason for short put exposures is that writing put options results in an attractive pay-off pattern under traditional performance measures. Goetzmann et al. (2002) show analytically that a short put-like payoff is optimal if one tries to maximize the Sharpe ratio. Generating a high Sharpe ratio with a strategy that does not necessarily involve skill can be called 'informationless investing', a term coined by Weisman (2002). According to Weisman, the hedge fund industry is particularly vulnerable to adopting such strategies. In another context, Brown et al. (2005) find that Australian equity managers show patterns of trading that seem to be aimed at payoffs with a large downside risk but, nonetheless, an attractive Sharpe-ratio. Siegmann and Lucas (2007) show that even if the Sharpe ratio is replaced by a downside risk measure, short put options remain attractive using statistical performance measures.

Our paper addresses a number of important issues in this context. Our work is related to that of de los Rios and Garcia (2005), who consider a very general approach to assessing nonlinear factor exposures but do not consider option returns. First, we extend the estimation and risk factor selection strategies of Agarwal and Naik (2004) over a more recent period. We find similar results as Agarwal and Naik, in that for some hedge fund indices, significant loadings to option returns are found. However, these loadings are not stable over the pre-bubble and post-bubble period. This questions the stability of style regression results for hedge funds. In addition, we find that the call option loadings do not correspond to the put loadings, although put-call parity suggests they should be. This is surprising, as especially the put option factors have attracted attention in the literature, Agarwal and Naik (2004), and enjoy some theoretical support; see Goetzmann et al. (2002). The call options are supposed to be in line with trend following strategies or market timing ability, see Merton (1981) and Fung and Hsieh (2002), but we do not find evidence for this either. The only exception is Merger Arbitrage, for which existing theory predicts short-put like payoff patterns, which we corroborate.

The rest of this paper proceeds as follows. Section 2 estimates the exposures of index returns to market- and option-based factors for the two subperiods. Section 3 considers portfolios of individual hedge funds constructed by sorting on fund characteristics. Section 5 concludes.

2 Data

The index data used in this paper are from Hedge Fund Research (hfr.com) and Credit Suisse / Tremont (hedgeindex.com). Since the latter is derived from the TASS hedge fund database, we refer to this source as the TASS indices. Both sets of indices are publicly available. The TASS indices are value-weighted and have a minimum fund size of $ 50 million. The HFR indices are equally weighted with no asset-size minimum. Both indices provide returns on different hedge fund styles, such as Emerging Markets, US equity, Dedicated Short bias, Managed Futures, Global Macro, and so on. These style attributes have been used in previous literature to distinguish specific substyles of hedge fund returns. The complete catalogue of styles used can be found in Table 1. For HFR, we have used the index definitions as in use before January 2008, when HFR introduced new style classicifcations.

Table 1 lists the market risk factors we use for the factor model estimation. S&P 500 (SPX), MSCI Emerging markets index (MEM), MSCI excluding the US (MXUS), Lehman Brothers Global High-Yield index (LHY), Federal Reserve Competitiveness-weighted Dollar Index (FRBI), Salomon Brothers World Government Bond Index (SBW), Salomon Brothers World Government and Corporate bond index (SBGC) and Goldman Sachs Commodity Index (GSCI) are from Datastream. DEF is the change in the default spread, where the spread is the difference between the yield on the BAA-rated corporate bonds and the 10-year Treasury constant maturity rate as provided by Federal Reserve Economic Data (FRED). SMB, HML, Rf are from Kenneth French's website where Rf is the 1-month Treasury bill rate provided by Ibbotson Associates. In addition, to compute the option-based risk factors we use as volatility the Chicago Board Options Exchange SPX volatility index (VIX), as provided by the CBOE.

The returns on two option-based risk factors, SPP and SPC, are computed using Black-

Scholes prices and the empirical risk-free rate, S&P 500 return (SPX) and the VIX index for the volatility. At the beginning of the month, we compute the Black-Scholes price of the call and option contract, expiring in 7 weeks (third week of next month). At the end of the month, we compute new prices using the empirical implied volatility, riskfree rate and return on the S&P. This method, which is also used by Agarwal and Naik (2004) for the period for which market option data were not available, provides us with 1-month option returns. We only use at-the-money options to avoid Black-Scholes pricing problems that are aggravated with out-of-the money options. Note that the out-of-the-money options used by Agarwal and Naik have strike prices that are only 1% higher or lower than the ATM factors. Also, in contrast to Agarwal and Naik, we use the S&P 500 index instead of the Russell 3000, to account for the fact that the SPX and SPP/SPC factors are related.

Table 2 provides the summary statistics of the hedge fund returns and the risk factors. If we look at the hedge fund return sample moments and the differences between the TASS and HFR data base, we see that some styles are fairly similar across data sets. For example, Convertible Arbitrage (CA) has similar moments for TASS and HFR. Other styles, however, may have substantially different higher order moments (e.g., Event Driven (ED)). This is also evident from a casual inspection of the minimum and maximum of the returns on the different hedge fund styles. The distinction between directional and non-directional hedge fund styles is based on Agarwal and Naik (2000), who classify hedge fund styles into those that have a directional aspect and those that have not.

The lower panel of Table 2 gives the sample summary statistics for the risk factors. Interestingly, there are substantial differences between the higher order moments of the risk factors and a number of the hedge fund returns. This signals that it may be hard to capture higher-order moments in a standard style regression framework.

3 Factor model estimates of index-returns

The basic claim of Agarwal and Naik (2004) is that a large number of equity-oriented hedge fund index-returns have a negative loading on the return on S&P 500 put options. The methodology of Agarwal and Naik has an implicit model selection procedure to strip down the complete set of 20 initial risk factors to a smaller set. However, this makes it hard to compare the option factors across models as a result of the specification search. The estimates we report are obtained using all market risk factors.

3.1 HFR

The results for the HFR indices are in Table 3. The values for the adjusted R^2s in the table confirm the notion that several of the index returns can be reasonably well explained by a factor model. Five styles (ED, ENH, EH, SS, EM) have an R^2 between 78 and 92%. This seems to fly in the face of the earlier observations made by Fung and Hsieh (1997), who argue that the factor model approach of Sharpe (1992) for mutual funds does not work for hedge funds. They change the size and extent of exposures to different asset classes too quickly to be captured by a linear combination of market factors. Possibly, our results show that hedge funds have taken up more systematic risk, as a result of the spectacular growth in assets under management, or, the index-returns from the HFR database cannot be seen as representative for the returns to hedge fund investing for a typical investor.

A few observations on the factor loadings from the table. First, large loadings on SPX are, as expected, found for ENH, EH and SS (negative). Second, only three styles (CA, FI and EM) do *not* load significantly on SMB. SMB represents the excess return of small stocks relative to large stocks. Thus, the size premium is an is an important driver of hedge fund returns. Third, a large loading on the MSCI Emerging Markets index is only found for the Emerging Markets hedge fund index. Fourth, a large loading on high-yield (LHY) is as expected for DS, as LHY represents the returns to investing in distressed firms. The emerging market hedge fund index loads positively on SBGC and negatively on SBW. This is either multicollinearity (no: correlation .55), or emerging markets hedge funds pocketing the risk premium between corporate and sovereign bonds. (SBGC represents world corporate and government, SBW just government). The competitiveness-weighted dollar index (FRBI) has only a significant impact on Global Macro returns. For all the talk, commodity returns only have a significant affect for 4 hedge fund indices, and quite small. The Short Selling index is clearly a special category of hedge funds, having short exposure to SPX and SMB (as expected), but a large and significant exposure to HML.

Finally, the coefficient for SPP is negative for ED, RVA and MA. For Relative Value Arbitrage and Merger Arbitrage, this is as expected, see Mitchell and Pulvino (2001).

With respect to performance, the factor model suggests that the Emerging Market (EM) hedge fund style has significantly higher alpha than the other styles. This might be caused by the omission of systematic factors, given our limited set of 12 and the global scale of possible investments in that category.

DS, ED, CA, RVA and FI also have a significantly positive alpha, while the other index returns have no significant constant term. That would imply that less than half of the hedge fund index-returns would add value for an investor who already has exposure to the (tradable equivalents of the) market factors.

3.2 TASS

The TASS estimation results are in Table 6. Again, we observe that several of the index returns are quite well explained by a factor model. This holds particularly for Distressed Securites (DS), Event Driven (ED), Emerging Markets (EM), Long-Short Equity (LSE), and Dedicated Short Bias (DSB). These styles all have an adjusted R^2 of 60% or more.

Relative Arbitrage (RA) and Multi-strategy (MS) have R^2 values of 41% and 55%, respectively, which is substantially lower. At the lowest end, we find adjusted R^2s values of 22% for Convertible Arbitrage, 12% for Equity Market Neutral, 13% for Fixed Income, 24% for Global Macro (GM), and 24% for Managed Futures (MF). For managed futures, this might be caused by missing an apprioprate factor return, related to the futures market. For the market-neutral strategy, the low R^2 corresponds to the purpose of the strategy, which appears to work well. In all, the results suggest that a factor model works quite well in explaining the returns to hedge fund *indices*.

First, only the short selling strategy has a significant exposure to SPX (albeit negative). The hedge funds in the TASS database seem to have little direct exposure to large US stocks. Second, the Fama-French factors are again important, with 4 fund loading on HML and 6 on SMB. The emerging markets hedge funds have an exposure to the emerging markets factor, naturally, and LHY is significant for 8 out of 12 indices. For emerging markets, we find again the long-short combination of SBGC and -SBW, as found for HFR. Also similar is the positive loading of Macro on FRBI. The change in default spread is insignificant everywhere, and GSCI exposure is only visible for 2 strategies, but with a small loading.

For the TASS indices, only Distressed Securities (DS) has a significant loading on the put option return, -0.62. Such a finding corresponds to what Altman (1998) finds for the comovement of a defaulted bond index and the S&P 500: correlation under normal market circumstances is low, but in a bear market correlation goes up. According to Altman, this effect is due to contagion from liquid stock and bond markets to the illiquid market for distressed securities.

4 Are the option loadings robust?

Given the index-option exposures for three HFR indices and one TASS index, we now turn to the question of whether the loadings represent systematic risk factors in hedge fund returns. To test this, we consider robustness over different subperiods, consistency with put-call parity, and consistency with the relation between volatility and option prices. Given that HFR gave the most significant loadings, suggesting HFR contains more US-equity oriented hedge funds, we restrict the analysis to the HFR indices.

4.1 Robustness over time

Tables 4 and 5 give the factor model estimates for two different time periods. The results are for the HFR indices, which had three indices with a short put loading over the full period. Distressed Securities (DS) has a negative loading in the pre-bubble period and zero thereafter. Market Timing (MT) has a positive loading pre-bubble and negative post-bubble. Merger Arbitrage (MA) comes out consistently with a negative loading, both before and after the bubble. Based on these results, we should conclude that only Merger Arbitrage might be considered to have a consistent and significant exposure to the return on SPX put options. This would corroborate Mitchell and Pulvino (2001) who provide economic intuition for this pattern occuring in risk arbitrage strategies.

4.2 Put-call parity

In a Black-Scholes world there is a one-to-one relation between the price of a stock, a risk-free bond, a call and a put option (put-call parity). Although this does not translate to a one-to-one relationship in terms of *returns*, see Coval and Shumway (2001), the series are still closely related. As shown in Figure 1, the difference between the call and the put return has an almost linear relationship with the underlying index (SPX), with an R^2 of 0.90. Hence, this relationship should translate to the sign and size of the loadings of the option returns in the factor model. Specifically, replacing the variable SPP (put return) by SPC (call return) should give roughly the same coefficient.

Table 7 shows the results of the factor model estimation with SPP replaced by SPC. It shows that instead of 3 (for the put option factor) we now have 7 hedge fund indices that load on the call option factor. Also, the indices that had short SPP exposure (ED, RVA, MA) do not have a significant or negative exposure to SPC. Thus, overall, the call option factor seems to capture a completely different risk factor than the put option factor. This contrasts with the close relation between the call and put return, as outlined above. The exception is Merger Arbitrage, for which the significant short put loading of -0.67 is translated to a short call exposure of -0.47, albeit with only 90% significance.

4.3 Relation with implied volatility

Option prices are increasing in volatility, see Hull (2000). The construction of the option returns implies that the returns are increasing in changes in volatility. I.e., if during the month volatility increases, the price of the option increases, and, ceteris paribus, so does the return. Hence, if option returns are systematic risk factors for hedge funds, the *sign* of the loading on volatility changes should correspond to that of the option factor.

To test whether loadings on volatility changes are consistent with any of the option loadings, we re-run the factor regressions with SPP replaced by DVIX. DVIX is the change in the VIX, the CBOE Volatility Index, and represents the implied volatility from tradable options on the CBOE. The results are in Table 8.

The results indicate that DVIX has a positive and significant influence on hedge fund returns for 7 out of 12 indices. This suggests that the short put returns, which should be accompanied with short loadings on DVIX, are not a systematic risk factor. It also runs contrary to the idea that hedge funds have been 'selling volatility', a succesful strategy for hedge funds according to popular media, quoting market insiders. According to Table 8 most hedge funds are actually net long in volatility.

The positive loadings on DVIX are consistent with the previous subsection, where we found long call loadings for a number of styles. The correspondence between DVIX and SPC loadings is not 1-1, but it does give support to the suggestions that hedge funds are sophisticated market timers rather than selling put options.

5 Conclusion

Concluding, our results can be seen as the necessary backtesting to a phenomenon that might otherwise be considered accepted wisdom. I.e., that the nonstandard pay-offs generated by hedge funds might be replicated by simple put-option returns on the S&P 500. We show that it is not so simple.

Previous previous literature suggests that the returns on S&P put-options explain a significant portion of hedge fund portfolio-returns. In this paper we have thoroughly put this claim to the test. Using both HFR and TASS supplied indices, two different sample periods, replacing put by call returns, and testing for exposure to volatility, our general findings cast significant doubt on the adequacy of put option returns for capturing part of the return variation in hedge fund indices. This is relevant for both risk management of hedge fund portfolios, as well as financial institutions that offer synthetic hedge fund indices. Our results suggest that models for hedge fund performance or replication should in general not include returns to equity put-options.

Given the prevalence of call option loadings, our results suggest that call option returns seem might capture some systematic risk component. However, it might still be the case that option returns proxy for other systematic risk factors that are particularly of interest in the hedge fund context. The two prime examples that come to mind are (systematic) volatility risk and liquidity risk, see for example Chan et al. (2005). These come to mind as avenues for future research.

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Appendix: Tables and Figures

Table 1: Hedge fund indices and market factors

TASS hedge fund indices	
CA	Convertible Arbitrage
DSB	Dedicated Short Bias
EM	Emerging Markets
EMN	Equity Market Neutral
ED	Event Driven
FI	Fixed Income Arbitrage
GM	Global Macro
LSE	Long-Short Equity
MF	Managed Futures

HFR hedge fund indices	
CA	Convertible Arbitrage
DS	Distressed Securities
ED	Event Driven
EH	Equity Hedge
EM	Emering Markets
EMN	Equity Market Neutral
ENH	Equity Non-Hedge
MA	Merger Arbitrage
Macro	Macro
RVA	Relative Value Arbitrage
SS	Short Selling

Market Risk factors	
Rf	Risk-free rate, taken as the 90-day T-bill rate
SPX	Return on the S&P 500 composite index
LHY	Lehman Brother Global High Yield index
SBG	World government and corporate bond index
SBW	World government bond index
MEM	MSCI emerging markets index
MXUS	MSCI excluding the US index
FRBI	Federal Reserve Bank competitiveness-weighted dollar index
DEF	change in the default spread (in basis points)
SPP	return on an at-the-money put option on the S&P 500
SPC	return on an at-the-money call option on the S&P 500
SMB	Fama-French size factor (small minus big)
HML	Fama-French book-to-market factor (high minus low)
GSCI	Goldman Sachs commodity index

Table 2: Summary statistics

This table shows the summary statistics for the HFR indices (panel A), TASS/Tremont indices (panel B), and the market indices (panel C). The distinction directional v non-directional follows Agarwal and Naik (2000), as explained in the text.

Panel A: HFR hedge fund indices							
Hedge fund strategy	Mean	SD	Median	Skew	Kurt	Min	Max
Directional							
ED	1.04	1.79	1.28	-1.21	5.28	-8.90	5.13
RVA	0.78	0.88	0.80	-2.42	17.33	-5.80	2.80
CA	0.73	1.03	0.91	-0.96	1.85	-3.19	3.33
FI	0.64	0.86	0.73	-1.23	4.53	-3.27	3.28
MA	0.79	1.04	0.90	-1.90	8.63	-5.69	3.12
EMN	0.63	0.86	0.57	0.29	1.02	-1.67	3.59
DS	0.95	1.50	1.07	-1.56	8.99	-8.50	5.06
Non-directional							
Macro	0.82	2.00	0.72	0.07	1.16	-6.40	6.82
ENH	1.16	3.86	1.62	-0.49	0.84	-13.34	10.74
EH	1.13	2.47	1.15	0.30	2.19	-7.65	10.88
SS	0.25	5.76	-0.15	0.31	2.64	-21.21	22.84
EM	1.06	3.97	1.59	-1.01	5.48	-21.02	14.80
MT	0.96	2.13	0.98	0.16	-0.18	-4.41	6.43
Panel B: TASS/Tremont hedge fund indices							
Hedge fund strategy	Mean	SD	Median	Skew	Kurt	Min	Max
CA	0.71	1.32	1.02	-1.31	3.18	-4.68	3.57
DSB	-0.04	4.84	-0.42	0.86	2.16	-8.69	22.71
DS	1.06	1.77	1.21	-2.91	19.90	-12.45	4.10
MS	0.91	1.73	0.93	-2.38	15.81	-11.52	4.66
RA	0.64	1.19	0.57	-1.05	6.13	-6.15	3.81
EM	0.90	4.48	1.49	-0.74	5.33	-23.03	16.42
EMN	0.80	0.81	0.79	0.34	0.55	-1.15	3.26
ED	0.95	1.59	1.06	-3.32	23.98	-11.77	3.68
FI	0.51	1.05	0.72	-2.98	16.12	-6.96	2.05
GM	1.13	3.00	1.17	0.02	3.53	-11.55	10.60
LSE	1.00	2.82	0.86	0.20	4.27	-11.43	13.01
MF	0.58	3.43	0.34	0.00	0.26	-9.35	9.95
Panel C: Risk factors							
Risk factor	Mean	SD	Median	Skew	Kurt	Min	Max
RF	0.32	0.14	0.38	-0.63	-0.91	0.06	0.56
SPX	0.92	4.02	1.36	-0.61	0.92	-14.46	9.78
HML	0.33	3.48	0.33	0.09	3.10	-12.80	13.80
SMB	0.12	3.85	-0.17	0.93	7.97	-16.70	22.18
MEM	0.91	6.45	1.05	-0.83	2.14	-28.91	13.77
LHY	0.04	2.56	0.46	-1.61	8.79	-15.79	7.18
SBGC	0.51	1.24	0.65	-0.44	1.23	-4.26	4.26
SBW	0.52	1.85	0.29	0.32	0.31	-4.28	5.94
MXUS	0.78	4.01	0.88	-0.52	0.62	-12.75	10.44
FRBI	-0.12	1.75	0.01	-0.07	0.01	-4.46	4.44
DEF	0.54	12.56	-1.00	0.95	1.84	-25.00	48.00
GSCI	0.92	5.77	0.96	0.05	0.04	-14.41	16.88
SPP	-0.26	0.79	-0.58	1.62	2.68	-0.98	3.39
SPC	-0.01	0.64	-0.11	0.50	-0.66	-0.93	1.71

Table 3: HFR index regressions 1994-2007

Factor model estimates for each of the HFR indices.

	Const	SPX	HML	SMB	MEM	LHY	SBGC	SBW	MXUS	FRBI	DEF	GSCI	SPP	Adj. R^2
Non-directional														
ED	0.34***	0.15***	0.12***	0.22***	0.01	0.19***	-0.03	-0.02	0.01	-0.03	-0.01	0.01	-0.44***	0.78
	(2.99)	(2.86)	(5.19)	(10.47)	(0.61)	(4.57)	(-0.34)	(-0.19)	(0.29)	(-0.32)	(-1.55)	(0.92)	(-2.37)	
RVA	0.26***	0.01	0.05***	0.05***	-0.01	0.15***	0.00	-0.06	-0.02	-0.06	-0.01	0.02***	-0.34**	0.48
	(2.88)	(0.38)	(2.46)	(3.21)	(-0.83)	(3.16)	(0.06)	(-0.99)	(-0.60)	(-1.06)	(-1.43)	(2.67)	(-2.28)	
CA	0.31***	-0.02	0.01	0.03	-0.03	0.24***	-0.01	-0.06	-0.02	-0.09	-0.00	0.01	-0.27*	0.30
	(2.56)	(-0.47)	(0.44)	(1.58)	(-1.57)	(5.10)	(-0.10)	(-0.73)	(-0.38)	(-1.06)	(-0.19)	(0.67)	(-1.68)	
FI	0.33***	0.00	0.03	0.06***	-0.00	0.14***	0.09	-0.02	0.05	0.03	-0.01***	0.02*	0.03	0.48
	(3.33)	(0.01)	(1.63)	(4.40)	(-0.05)	(4.75)	(1.44)	(-0.26)	(1.43)	(0.45)	(-3.36)	(1.78)	(0.18)	
MA	0.04	0.03	0.10***	0.10***	-0.01	0.10**	-0.13*	-0.00	-0.02	-0.07	0.00	0.01	-0.67***	0.50
	(0.34)	(0.75)	(5.43)	(6.14)	(-0.42)	(2.02)	(-1.83)	(-0.05)	(-0.71)	(-1.05)	(0.53)	(1.28)	(-3.68)	
EMN	0.09	0.02	0.06***	0.07***	-0.05***	0.01	0.11	-0.13*	0.06*	-0.13*	0.01	0.01	-0.19	0.14
	(0.84)	(0.59)	(2.35)	(3.46)	(-2.88)	(0.26)	(1.38)	(-1.73)	(1.84)	(-1.77)	(1.20)	(1.29)	(-1.08)	
DS	0.41***	0.01	0.10***	0.15***	-0.00	0.23***	-0.05	0.07	0.05	0.04	-0.02*	0.01	-0.39*	0.58
	(2.91)	(0.12)	(2.84)	(5.69)	(-0.09)	(4.16)	(-0.46)	(0.59)	(0.70)	(0.36)	(-1.90)	(0.37)	(-1.75)	
Directional														
Macro	-0.00	-0.10	0.02	0.12***	0.11***	-0.02	0.49***	0.19	0.09	0.35**	0.00	0.05***	-0.71*	0.45
	(-0.01)	(-1.01)	(0.52)	(3.28)	(3.70)	(-0.23)	(3.44)	(1.14)	(1.44)	(2.13)	(0.05)	(2.53)	(-1.86)	
ENH	0.19	0.58***	-0.06	0.45***	0.08***	0.02	0.00	-0.02	0.02	-0.12	-0.00	0.03**	-0.25	0.92
	(1.33)	(7.11)	(-1.62)	(13.48)	(3.29)	(0.46)	(0.00)	(-0.15)	(0.32)	(-1.09)	(-0.03)	(2.10)	(-0.93)	
EH	0.32*	0.28***	-0.04	0.29***	0.03	-0.02	0.10	-0.12	0.06	-0.09	0.01	0.05***	-0.29	0.79
	(1.78)	(3.82)	(-1.00)	(9.66)	(1.07)	(-0.40)	(0.88)	(-1.02)	(1.42)	(-0.79)	(0.83)	(3.29)	(-1.03)	
SS	0.29	-0.84***	0.46***	-0.60***	0.03	-0.05	-0.02	-0.10	-0.04	-0.04	-0.00	-0.03	-0.13	0.80
	(0.92)	(-5.57)	(6.06)	(-9.74)	(0.57)	(-0.43)	(-0.08)	(-0.30)	(-0.38)	(-0.14)	(-0.18)	(-0.94)	(-0.20)	
EM	0.67***	-0.04	-0.00	0.06	0.48***	0.20***	0.36**	-0.40**	0.08	-0.11	-0.02	0.02	0.36	0.81
	(2.66)	(-0.28)	(-0.02)	(1.52)	(11.20)	(2.44)	(2.07)	(-2.28)	(0.65)	(-0.69)	(-0.91)	(0.82)	(0.92)	
MT	0.11	0.17***	-0.04	0.11***	0.09***	-0.25***	0.46***	-0.35**	0.15**	-0.24	0.01	0.02	-0.14	0.61
	(0.56)	(2.53)	(-0.89)	(2.77)	(2.75)	(-2.65)	(3.18)	(-2.00)	(2.12)	(-1.45)	(0.51)	(1.22)	(-0.48)	

Table 4: HFR index regressions 1994-2000

Factor model estimates for each of the HFR indices.

	Const	SPX	HML	SMB	MEM	LHY	SBGC	SBW	MXUS	FRBI	DEF	GSCI	SPP	Adj. R^2
Non-directional														
ED	0.64***	0.28***	0.21***	0.28***	0.01	0.18***	-0.02	-0.08	-0.01	-0.03	-0.03***	0.01	-0.13	0.79
	(3.59)	(4.55)	(6.01)	(9.64)	(0.23)	(3.84)	(-0.17)	(-0.42)	(-0.17)	(-0.16)	(-3.06)	(0.55)	(-0.58)	
RVA	0.32**	0.15***	0.15***	0.13***	-0.06***	0.20***	-0.14	-0.10	-0.03	-0.05	-0.02*	0.03***	-0.26	0.69
	(2.24)	(2.91)	(5.06)	(8.57)	(-3.11)	(5.04)	(-1.25)	(-1.02)	(-1.02)	(-0.58)	(-1.92)	(2.41)	(-1.20)	
CA	0.45***	-0.01	0.07*	0.07***	-0.02	0.25***	-0.06	-0.01	0.00	0.03	0.00	-0.00	-0.34	0.42
	(2.47)	(-0.13)	(1.78)	(3.16)	(-1.02)	(3.03)	(-0.40)	(-0.06)	(0.08)	(0.22)	(0.06)	(-0.09)	(-1.28)	
FI	0.35**	0.02	0.07***	0.09***	-0.00	0.10***	0.18*	-0.11	0.06*	0.04	-0.03***	0.00	0.02	0.48
	(1.99)	(0.35)	(3.08)	(5.28)	(-0.15)	(2.39)	(1.76)	(-0.72)	(1.95)	(0.40)	(-4.30)	(0.12)	(0.08)	
MA	0.35**	0.10**	0.13***	0.12***	-0.02	0.17***	-0.28***	-0.06	-0.07**	-0.16	-0.00	0.00	-0.52**	0.53
	(2.09)	(2.05)	(3.64)	(5.33)	(-0.93)	(2.60)	(-2.44)	(-0.48)	(-2.26)	(-1.24)	(-0.30)	(0.00)	(-2.27)	
EMN	0.22	0.12**	0.05	0.09***	-0.09***	0.08	0.01	-0.14	0.06	-0.14	0.00	0.01	-0.05	0.18
	(1.16)	(2.00)	(1.19)	(2.71)	(-3.29)	(1.37)	(0.10)	(-0.91)	(1.60)	(-0.99)	(0.51)	(0.38)	(-0.18)	
DS	0.10	0.08	0.23***	0.24***	-0.03	0.21***	-0.13	-0.12	0.07	-0.02	-0.02	0.01	-0.69**	0.74
	(0.45)	(1.10)	(5.93)	(8.01)	(-0.92)	(4.23)	(-0.96)	(-0.66)	(1.21)	(-0.15)	(-1.39)	(0.39)	(-2.31)	
Directional														
Macro	0.30	0.04	0.03	0.17***	0.10**	-0.04	0.59***	0.24	0.13*	0.76***	-0.01	0.02	-0.35	0.56
	(0.68)	(0.31)	(0.42)	(3.59)	(2.28)	(-0.39)	(2.61)	(0.77)	(1.93)	(2.62)	(-0.49)	(0.71)	(-0.54)	
ENH	0.26	0.76***	-0.01	0.54***	0.04	-0.03	-0.46**	0.38*	-0.00	0.27	-0.01	0.01	-0.19	0.90
	(0.87)	(6.61)	(-0.19)	(12.92)	(1.02)	(-0.26)	(-2.05)	(1.73)	(-0.08)	(1.39)	(-0.39)	(0.32)	(-0.43)	
EH	0.90***	0.52***	-0.02	0.38***	0.02	-0.05	-0.13	0.08	0.04	0.16	0.00	0.05*	0.30	0.81
	(3.08)	(4.89)	(-0.36)	(9.13)	(0.47)	(-0.57)	(-0.65)	(0.40)	(0.91)	(0.87)	(0.13)	(1.73)	(0.71)	
SS	0.84	-0.86***	0.54***	-0.75***	-0.04	0.09	0.85	-1.50**	-0.01	-1.14*	-0.00	0.08	0.65	0.82
	(1.59)	(-3.63)	(4.43)	(-8.41)	(-0.52)	(0.47)	(1.37)	(-2.03)	(-0.05)	(-1.87)	(-0.11)	(1.37)	(0.68)	
EM	1.09***	0.24	0.17	0.20***	0.50***	0.20*	0.34	-0.57*	0.07	-0.12	-0.05	0.03	1.08*	0.82
	(2.68)	(1.24)	(1.64)	(2.91)	(8.05)	(1.89)	(0.92)	(-1.76)	(0.53)	(-0.50)	(-1.25)	(0.55)	(1.76)	
MT	0.86***	0.33***	-0.16***	0.07*	0.06	-0.22**	0.32	-0.06	0.19**	0.19	0.03	0.01	0.91**	0.59
	(2.58)	(3.28)	(-3.03)	(1.72)	(1.52)	(-1.98)	(1.49)	(-0.27)	(2.12)	(0.93)	(1.61)	(0.38)	(1.97)	

Table 5: HFR index regressions 2000-2007

Factor model estimates for each of the HFR indices.

	Const	SPX	HML	SMB	MEM	LHY	SBGC	SBW	MXUS	FRBI	DEF	GSCI	SPP	Adj. R^2
Non-directional														
ED	0.16	0.05	0.08***	0.20***	0.02	0.22***	-0.02	-0.04	0.08	-0.06	0.00	0.00	-0.48*	0.80
	(1.27)	(0.80)	(2.66)	(5.79)	(0.61)	(3.54)	(-0.20)	(-0.28)	(1.62)	(-0.54)	(0.20)	(0.13)	(-1.95)	
RVA	0.21***	-0.04	0.02	0.01	0.04**	0.10***	0.06	-0.12*	0.00	-0.14**	-0.00	0.01	-0.11	0.47
	(3.19)	(-0.98)	(1.18)	(0.42)	(2.29)	(3.26)	(1.19)	(-1.80)	(0.06)	(-2.14)	(-0.48)	(0.87)	(-0.86)	
CA	0.21	-0.02	0.00	0.04	-0.01	0.18***	0.04	-0.22**	-0.05	-0.32***	-0.01	0.01	0.05	0.20
	(1.37)	(-0.25)	(0.09)	(1.28)	(-0.19)	(3.87)	(0.54)	(-2.03)	(-0.99)	(-2.75)	(-1.11)	(0.49)	(0.27)	
FI	0.30***	0.03	0.01	0.04*	0.01	0.17***	-0.00	0.06	0.00	-0.00	-0.01	0.02**	0.04	0.55
	(2.73)	(0.63)	(0.57)	(1.94)	(0.39)	(3.80)	(-0.02)	(0.76)	(0.08)	(-0.04)	(-1.33)	(2.01)	(0.26)	
MA	-0.20*	-0.04	0.11***	0.08***	0.01	0.06*	0.06	-0.03	0.08*	0.00	0.01	0.02*	-0.63***	0.60
	(-1.79)	(-0.81)	(5.24)	(3.53)	(0.28)	(1.95)	(0.79)	(-0.30)	(1.77)	(0.00)	(1.01)	(1.82)	(-3.19)	
EMN	-0.11	-0.03	0.11***	0.04**	0.02	-0.08*	0.16*	-0.20***	0.02	-0.20***	-0.00	0.01	-0.09	0.26
	(-1.23)	(-0.39)	(3.80)	(2.09)	(0.92)	(-1.78)	(1.89)	(-2.52)	(0.44)	(-2.89)	(-0.47)	(0.64)	(-0.59)	
DS	0.56***	0.06	0.05	0.14***	0.00	0.21***	-0.08	0.09	0.00	-0.06	-0.01	-0.00	-0.07	0.46
	(2.87)	(0.71)	(0.98)	(2.81)	(0.04)	(2.78)	(-0.53)	(0.53)	(0.03)	(-0.35)	(-1.35)	(-0.11)	(-0.21)	
Directional														
Macro	-0.35**	-0.17*	0.04	0.12***	0.13***	-0.10	0.22	0.12	-0.01	-0.16	-0.01	0.05***	-0.85***	0.52
	(-2.22)	(-1.72)	(1.23)	(2.52)	(4.75)	(-1.41)	(1.45)	(0.74)	(-0.16)	(-1.13)	(-0.88)	(2.49)	(-2.34)	
ENH	-0.02	0.45***	-0.07*	0.38***	0.15***	0.08	0.19*	-0.24*	0.02	-0.27***	0.00	0.04**	-0.19	0.95
	(-0.18)	(4.57)	(-1.88)	(11.80)	(5.48)	(1.27)	(1.73)	(-1.86)	(0.33)	(-2.61)	(0.32)	(1.99)	(-0.75)	
EH	-0.20*	0.10	0.02	0.19***	0.10***	-0.01	0.15	-0.22**	0.08	-0.21**	0.00	0.04*	-0.41*	0.86
	(-1.74)	(1.05)	(0.64)	(6.17)	(3.77)	(-0.16)	(1.45)	(-1.97)	(1.40)	(-2.12)	(0.34)	(1.86)	(-1.81)	
SS	0.11	-1.04***	0.31***	-0.38***	0.04	0.07	-0.32	0.35	0.12	0.35	0.02	-0.09*	-0.41	0.84
	(0.31)	(-4.86)	(2.96)	(-5.77)	(0.66)	(0.56)	(-1.50)	(1.63)	(0.80)	(1.64)	(1.29)	(-1.96)	(-0.66)	
EM	0.42***	-0.14	-0.03	0.05	0.37***	0.16***	0.30**	-0.29**	0.15*	-0.16	0.00	0.01	-0.12	0.88
	(2.37)	(-1.46)	(-0.61)	(1.11)	(10.23)	(2.35)	(2.27)	(-2.05)	(1.79)	(-1.14)	(0.36)	(0.33)	(-0.38)	
MT	-0.54***	-0.02	0.03	0.12**	0.17***	-0.28***	0.41***	-0.42**	0.06	-0.47***	-0.02*	0.04**	-0.95***	0.73
	(-3.20)	(-0.26)	(0.76)	(2.30)	(3.04)	(-3.53)	(3.20)	(-2.05)	(0.74)	(-2.35)	(-1.90)	(2.29)	(-3.15)	

Table 6: TASS/CSFB index regressions 1994-2007

Factor model estimates for each of the TASS/CSFB, currently Hedgeindex indices.

	Const	SPX	HML	SMB	MEM	LHY	SBGC	SBW	MXUS	FRBI	DEF	GSCI	SPP	Adj. R^2
Non-directional														
CA	0.30*	-0.05	0.06*	0.05*	-0.05**	0.30***	-0.02	-0.16	0.00	-0.12	-0.00	0.01	-0.30	0.24
	(1.83)	(-0.62)	(1.83)	(1.75)	(-1.98)	(5.68)	(-0.15)	(-1.44)	(0.04)	(-1.23)	(-0.08)	(0.93)	(-1.31)	
DS	0.44***	-0.02	0.07*	0.09***	-0.01	0.34***	-0.05	0.01	0.05	0.03	-0.02*	0.02	-0.62**	0.60
	(2.70)	(-0.25)	(1.96)	(2.60)	(-0.28)	(3.96)	(-0.44)	(0.11)	(0.91)	(0.26)	(-1.95)	(1.31)	(-2.20)	
EMN	0.42***	0.06	0.01	0.00	0.01	0.03	-0.04	0.06	-0.00	0.02	0.00	0.01	-0.02	0.11
	(4.33)	(1.36)	(0.47)	(0.04)	(0.58)	(0.89)	(-0.43)	(0.64)	(-0.00)	(0.23)	(1.08)	(1.20)	(-0.13)	
FI	0.09	-0.12	0.03	0.00	-0.02	0.17***	0.08	-0.08	0.04	-0.00	-0.01	0.02**	-0.33	0.15
	(0.53)	(-1.57)	(1.11)	(0.13)	(-0.75)	(3.57)	(0.77)	(-0.67)	(0.70)	(-0.02)	(-1.50)	(2.19)	(-1.38)	
ED	0.38***	-0.01	0.08***	0.09***	0.02	0.26***	-0.01	-0.12	0.07	-0.04	-0.01	0.02*	-0.41	0.63
	(2.62)	(-0.12)	(2.84)	(3.78)	(0.82)	(3.06)	(-0.07)	(-1.08)	(1.15)	(-0.47)	(-1.14)	(1.82)	(-1.59)	
RA	0.11	0.07	0.10***	0.11***	0.02	0.08	-0.13	0.04	0.00	-0.04	0.00	-0.00	-0.20	0.38
	(0.80)	(1.31)	(3.37)	(3.81)	(1.04)	(1.37)	(-1.53)	(0.42)	(0.06)	(-0.39)	(0.63)	(-0.09)	(-0.92)	
Directional														
EM	0.68**	-0.20	-0.08	-0.00	0.47***	0.35***	0.58**	-0.63**	0.14	-0.11	-0.02	0.01	0.38	0.66
	(1.96)	(-1.14)	(-1.14)	(-0.08)	(6.64)	(2.51)	(2.19)	(-2.04)	(0.81)	(-0.40)	(-0.93)	(0.38)	(0.68)	
GM	0.35	-0.09	0.08	0.08	0.08	0.05	0.63**	0.20	0.07	0.77***	-0.01	0.05	-0.97	0.22
	(0.93)	(-0.54)	(0.99)	(1.26)	(1.20)	(0.45)	(2.10)	(0.57)	(0.50)	(2.64)	(-0.54)	(1.52)	(-1.57)	
MS	0.42***	0.00	0.08***	0.10***	0.04	0.21***	0.06	-0.26	0.08	-0.11	-0.01	0.03*	-0.18	0.52
	(2.41)	(0.03)	(2.44)	(3.32)	(1.13)	(2.39)	(0.49)	(-1.61)	(1.06)	(-0.81)	(-0.57)	(1.76)	(-0.60)	
LSE	0.12	0.13	-0.14**	0.26***	0.03	0.06	0.38**	-0.21	0.12*	-0.15	0.01	0.05**	-0.52	0.66
	(0.47)	(1.21)	(-2.12)	(5.73)	(0.68)	(0.65)	(2.15)	(-1.23)	(1.85)	(-0.91)	(0.96)	(2.32)	(-1.25)	
DSB	0.36	-0.76***	0.13	-0.40***	-0.00	-0.24**	0.20	-0.02	0.12	0.25	0.01	-0.01	0.52	0.75
	(1.00)	(-5.11)	(1.57)	(-5.40)	(-0.10)	(-2.16)	(0.80)	(-0.07)	(1.30)	(0.98)	(0.36)	(-0.20)	(0.91)	
MF	-0.47	-0.22	0.14	0.05	0.15*	-0.42***	0.58	0.33	0.10	0.08	0.00	0.07*	-0.62	0.12
	(-1.00)	(-1.14)	(1.43)	(0.62)	(1.94)	(-2.36)	(1.42)	(0.67)	(0.63)	(0.19)	(0.14)	(1.66)	(-0.76)	

Table 7: HFR index regressions with call option factor

Factor model estimates for each of the HFR indices, with the call option factor.

	Const	SPX	HML	SMB	MEM	LHY	SBGC	SBW	MXUS	FRBI	DEF	GSCI	SPC	Adj. R^2
Non-directional														
ED	0.70***	0.17***	0.11***	0.22***	0.01	0.20***	0.02	-0.11	0.02	-0.08	-0.01	0.01	0.37*	0.77
	(5.53)	(2.89)	(4.71)	(9.93)	(0.46)	(4.27)	(0.22)	(-1.00)	(0.43)	(-0.83)	(-1.51)	(1.04)	(1.68)	
RVA	0.44***	0.07	0.05***	0.06***	-0.01	0.15***	0.04	-0.11	-0.01	-0.08	-0.01	0.02***	0.04	0.46
	(3.78)	(1.34)	(2.33)	(3.39)	(-0.87)	(3.20)	(0.54)	(-1.45)	(-0.44)	(-1.22)	(-1.41)	(2.73)	(0.19)	
CA	0.64***	-0.05	0.00	0.03	-0.03*	0.25***	0.02	-0.15	-0.01	-0.14	-0.00	0.01	0.47**	0.31
	(5.24)	(-0.85)	(0.13)	(1.46)	(-1.74)	(5.41)	(0.29)	(-1.54)	(-0.33)	(-1.61)	(-0.16)	(0.74)	(2.17)	
FI	0.52***	-0.08	0.02	0.05***	-0.00	0.15***	0.09	-0.08	0.05*	-0.02	-0.01***	0.01*	0.47	0.51
	(4.06)	(-1.24)	(1.15)	(4.35)	(-0.26)	(4.43)	(1.42)	(-0.77)	(1.67)	(-0.25)	(-3.45)	(1.79)	(1.60)	
MA	0.17	0.21***	0.11***	0.11***	-0.00	0.09*	-0.07	-0.02	-0.01	-0.05	0.00	0.02	-0.43*	0.47
	(1.42)	(4.50)	(5.35)	(6.42)	(-0.26)	(1.85)	(-0.93)	(-0.26)	(-0.41)	(-0.68)	(0.45)	(1.53)	(-1.85)	
EMN	0.25*	0.03	0.06**	0.07***	-0.05***	0.02	0.13*	-0.17**	0.06*	-0.15**	0.01	0.02	0.16	0.14
	(1.87)	(0.69)	(2.27)	(3.49)	(-2.97)	(0.35)	(1.68)	(-2.23)	(1.93)	(-2.08)	(1.21)	(1.37)	(0.69)	
DS	0.90***	-0.04	0.09***	0.15***	-0.01	0.25***	-0.01	-0.06	0.05	-0.04	-0.02*	0.01	0.73**	0.59
	(5.60)	(-0.42)	(2.49)	(5.25)	(-0.32)	(3.88)	(-0.06)	(-0.48)	(0.85)	(-0.41)	(-1.87)	(0.47)	(2.12)	
Directional														
Macro	0.95***	-0.20***	-0.01	0.11***	0.10***	0.02	0.57***	-0.07	0.10*	0.18	0.00	0.05***	1.47***	0.48
	(4.49)	(-2.48)	(-0.12)	(3.09)	(3.51)	(0.38)	(4.08)	(-0.43)	(1.92)	(1.13)	(0.13)	(2.87)	(4.07)	
ENH	0.64***	0.50***	-0.07**	0.45***	0.07***	0.05	0.03	-0.14	0.02	-0.20*	0.00	0.03**	0.78***	0.92
	(4.69)	(7.27)	(-2.11)	(13.31)	(3.00)	(0.98)	(0.26)	(-1.01)	(0.43)	(-1.74)	(0.02)	(2.23)	(2.78)	
EH	0.54***	0.30***	-0.05	0.30***	0.03	-0.01	0.13	-0.17	0.06	-0.11	0.01	0.05***	0.19	0.78
	(3.56)	(4.74)	(-1.08)	(9.34)	(1.00)	(-0.29)	(1.15)	(-1.39)	(1.52)	(-0.98)	(0.84)	(3.39)	(0.69)	
SS	-0.24	-0.61***	0.49***	-0.58***	0.04	-0.08	-0.02	0.05	-0.04	0.08	-0.00	-0.03	-1.38***	0.81
	(-0.85)	(-5.46)	(6.74)	(-9.85)	(0.76)	(-0.80)	(-0.08)	(0.16)	(-0.39)	(0.28)	(-0.21)	(-0.95)	(-2.44)	
EM	0.92***	-0.26*	-0.02	0.05	0.47***	0.23***	0.33*	-0.49***	0.08	-0.19	-0.02	0.02	1.00**	
	(3.69)	(-1.74)	(-0.40)	(1.19)	(11.30)	(2.59)	(1.91)	(-2.40)	(0.66)	(-1.22)	(-0.88)	(0.75)	(1.97)	0.82
MT	0.77***	-0.02	-0.06	0.10***	0.08***	-0.21***	0.48***	-0.54***	0.15***	-0.38**	0.01	0.02	1.39***	0.65
	(4.09)	(-0.19)	(-1.58)	(2.48)	(2.54)	(-2.93)	(3.67)	(-2.90)	(2.59)	(-2.19)	(0.60)	(1.20)	(3.44)	

Table 8: HFR index regressions with DVIX

Factor model estimates for each of the HFR indices, with DVIX.

	Const	SPX	HML	SMB	MEM	LHY	SBGC	SBW	MXUS	FRBI	DEF	GSCI	DVIX	Adj. R^2
Non-directional														
ED	0.51***	0.26***	0.12***	0.23***	0.01	0.20***	0.02	-0.11	0.02	-0.07	-0.01*	0.01	0.07***	0.78
	(6.47)	(6.34)	(5.52)	(10.57)	(0.66)	(4.47)	(0.29)	(-0.94)	(0.45)	(-0.69)	(-1.69)	(1.11)	(3.47)	
RVA	0.41***	0.09***	0.05***	0.06***	-0.01	0.16***	0.04	-0.12*	-0.01	-0.08	-0.01	0.02***	0.03	0.47
	(7.45)	(3.04)	(2.64)	(3.62)	(-0.82)	(3.17)	(0.59)	(-1.71)	(-0.42)	(-1.37)	(-1.52)	(2.79)	(1.06)	
CA	0.41***	0.06*	0.02	0.04*	-0.03	0.25***	0.03	-0.13	-0.01	-0.12	-0.00	0.01	0.07***	0.32
	(4.72)	(1.66)	(0.60)	(1.92)	(-1.59)	(5.78)	(0.36)	(-1.49)	(-0.29)	(-1.44)	(-0.33)	(0.82)	(3.05)	
FI	0.29***	0.04	0.03*	0.06***	0.00	0.15***	0.10	-0.07	0.05	-0.00	-0.02***	0.02*	0.08**	0.54
	(4.94)	(1.21)	(1.86)	(4.48)	(0.02)	(4.41)	(1.48)	(-0.72)	(1.54)	(-0.01)	(-3.43)	(1.87)	(2.27)	
MA	0.35***	0.14***	0.10***	0.10***	-0.01	0.09*	-0.07	-0.07	-0.01	-0.09	0.00	0.02	-0.01	0.45
	(5.08)	(5.43)	(5.09)	(6.00)	(-0.48)	(1.87)	(-0.87)	(-0.87)	(-0.41)	(-1.27)	(0.54)	(1.47)	(-0.39)	
EMN	0.17**	0.07***	0.07***	0.07***	-0.05***	0.02	0.13*	-0.17**	0.06**	-0.14**	0.01	0.02	0.03	0.14
	(2.31)	(2.54)	(2.45)	(3.72)	(-2.92)	(0.38)	(1.72)	(-2.19)	(2.00)	(-1.97)	(1.09)	(1.41)	(1.29)	
DS	0.57***	0.10*	0.10***	0.16***	-0.00	0.24***	-0.01	0.00	0.05	0.01	-0.02*	0.01	0.04	0.58
	(6.69)	(1.85)	(2.95)	(5.72)	(-0.09)	(3.99)	(-0.06)	(0.02)	(0.77)	(0.09)	(-1.92)	(0.51)	(1.21)	
Directional														
Macro	0.28**	0.08	0.03	0.13***	0.11***	0.01	0.57***	0.04	0.10*	0.28	-0.00	0.06***	0.12***	0.46
	(2.16)	(1.27)	(0.68)	(3.60)	(3.90)	(0.12)	(4.06)	(0.23)	(1.72)	(1.63)	(-0.12)	(2.79)	(2.45)	
ENH	0.26***	0.68***	-0.05	0.46***	0.08***	0.05	0.04	-0.12	0.02	-0.17	-0.00	0.04**	0.12***	0.92
	(2.50)	(12.50)	(-1.59)	(14.45)	(3.46)	(1.13)	(0.34)	(-0.93)	(0.45)	(-1.55)	(-0.26)	(2.32)	(4.43)	
EH	0.40***	0.40***	-0.04	0.31***	0.03	0.01	0.15	-0.23*	0.07*	-0.14	0.01	0.05***	0.13***	0.80
	(4.30)	(8.98)	(-0.94)	(9.80)	(1.19)	(0.15)	(1.35)	(-1.90)	(1.72)	(-1.23)	(0.66)	(3.49)	(4.05)	
SS	0.36*	-0.84***	0.46***	-0.60***	0.03	-0.05	-0.01	-0.10	-0.04	-0.04	-0.00	-0.03	-0.03	0.80
	(1.68)	(-7.88)	(6.02)	(-9.61)	(0.57)	(-0.50)	(-0.05)	(-0.30)	(-0.38)	(-0.12)	(-0.16)	(-0.94)	(-0.46)	
EM	0.44***	-0.03	0.00	0.07	0.48***	0.23***	0.34**	-0.45***	0.08	-0.15	-0.02	0.02	0.14***	0.82
	(3.00)	(-0.31)	(0.08)	(1.62)	(11.85)	(2.74)	(1.97)	(-2.48)	(0.65)	(-0.95)	(-1.02)	(0.82)	(2.52)	
MT	0.15	0.24***	-0.03	0.12***	0.09***	-0.24***	0.48***	-0.41**	0.15**	-0.28	0.00	0.03	0.08*	0.62
	(1.22)	(3.97)	(-0.80)	(2.77)	(2.73)	(-2.83)	(3.56)	(-2.32)	(2.28)	(-1.61)	(0.41)	(1.25)	(1.67)	

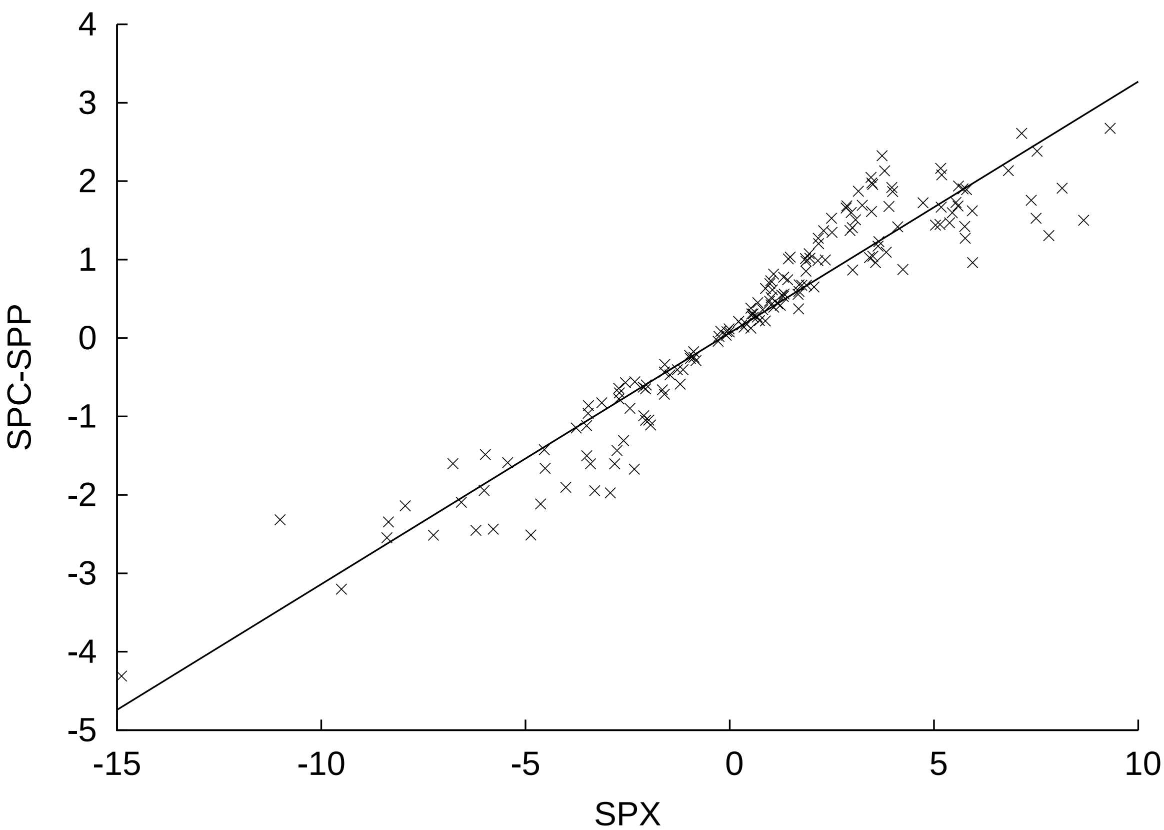

Figure 1: Collinearity of the option factors with the SPX return.

A scatterplot of SPC minus SPP against the S&P 500 returns (SPX). The straight line represents the fitted OLS estimate, $y = 0.07 + 0.32 \cdot x$, with an R^2 of 0.90.