



## Optional and Conditional Components in Hedge Fund Returns

### **Georges Hübner**

Deloitte Prof. of Financial Management, HEC-Univ. of Liège  
Associate Prof. of Finance, Maastricht University  
Research Director, Luxembourg School of Finance  
Affiliate Professor, EDHEC Business School  
E-mail: [g.hubner@ulg.ac.be](mailto:g.hubner@ulg.ac.be)

### **Nicolas Papageorgiou**

Assistant Prof. of Finance, HEC Montreal

# Agenda

---

- Shortcomings of the style- or factor-based analyses
- Methods for inclusion of optional and conditional risk premia
- Performance of pricing models
- Persistence analysis in bull and bear markets
- Conclusion

# Shortcomings of style- or factor-based analyses

## Historical perspective

---

- Early research attempted to perform Sharpe (1992) style-based analysis to explain hedge fund returns
  - Fung and Hsieh (RFS 1997): 9 premiums,  $R^2$  from 17% to 70%
  - Liang (FAJ 1999): 8 premiums,  $R^2$  from 20% to 77%
- Later, following the work of Carhart (1997) on mutual fund performance and persistence, it has been common to add the “traditional” factors of the empirical CAPM: size, value-growth, momentum.
- But the most important addition to HF pricing models has been the inclusion of option-based risk premiums

# Shortcomings of style- or factor-based analyses

## Summary of research on optional premia

---

- Mitchell and Pulvino (JF 2001) introduce piecewise linear regressions to account for non-linearities in hedge fund returns for *risk arbitrage* strategies. Their  $R^2$  with only the market premium reaches 46%
- Fung and Hsieh (RFS 2001) introduce risk premiums accounting for option straddles (long call + long put) for *trend-following* funds. Their  $R^2$  improves by 48%!
- Agarwal and Naik (RFS 2004) use a framework developed by Glosten and Jagannathan (1994) to estimate the returns of exchange-traded ATM and OTM calls and puts
  - They use the closest strike for ATM options
  - They use the next higher/lower strike for OTM options

# Shortcomings of style- or factor-based analyses

## Summary of research on optional premia (cont'd)

---

- Option prices can also be used to capture the stock market sentiment through *implied volatilities*
  - The easiest way to deal with it is to use the changes in the VIX index in the pricing model (e.g. Amenc, Martellini and Vaissié, JAM 2003; Chen and Liang, WP 2005)
  - Some also use the VIX as a lagged instrument (Kazemi and Schneeweis, WP 2003)
- Options also feature information about *risk neutral valuation* embedded in option pricing
  - This idea was theoretically formalized by Kakshi, Kapadia and Madan (RFS 2003) who identified the prices of the variance, skewness and kurtosis contracts
  - Bondarenko (WP 2006) applies the volatility contract and finds that this contract risk is rewarded for hedge funds
  - Dennis and Mayhew (JFQA 2002) measure risk-neutral skewness and find that it explains stock prices

# Methods for inclusion of optional and conditional risk premia

## Presentation of the study

---

- We perform a comprehensive study of hedge fund persistence and performance for the period 1994-2003
- Funds have been classified into three categories:
  - Non-directional (800 funds, 519 alive)
  - Directional (1218 funds, 644 alive)
  - Funds of funds (599 funds, 408 alive)
- Three sub-periods are considered for persistence analysis:
  - The “pre-bubble” period 1994-1997 (only for portfolio formation)
  - The bubble period 1998-06:2000 (30 months)
  - The dull period 07:2000-2003 (30 months)

Underlying logic: if there is evidence of persistence for extreme market conditions, it is likely to hold during mixed periods

# Methods for inclusion of optional and conditional risk premia

## Traditional factors and instruments

---

- Selection of “traditional” factors:
  - 4 Inputs of the empirical CAPM (market, size, value/growth and momentum factors)
  - 3 Style benchmarks that have proven relevant for hedge funds: emerging bond index, government bond index, world equities excl. US
  - 1 New factor accounting for market sentiment: the NBER Experimental Recession Index
- Selection of instruments:
  - 4 lagged variables already used in past studies: T-bill rate, Credit spreads, Term spreads, VIX index
  - These lagged variables are multiplied with current factors to get the conditional variables (at most 1 per instrument)

# Methods for inclusion of optional and conditional risk premia

## Optional factors

---

- Selection of 6 types of optional factors:

1. Changes in the VIX index

2. Artificial option returns (*à la Glosten & Jagannathan, improved methodology*)

Each month, compute the Black-Scholes values of the 1 month ATM and OTM (at 5% of the strike price) calls and puts (4 series). Record the realized monthly return

3. Realized option returns (*à la Agarwal & Naik, improved methodology*)

Each month, interpolate the price of the calls and puts *exactly* ATM and *exactly* 5% OTM. The next month, interpolate the price of an option with *exactly* the same strike price, and compute the rate of return

→ Homogenous series of option returns

→ Improved criterion for OTM option selection

# Methods for inclusion of optional and conditional risk premia

## Optional factors (cont'd)

---

### 4. Risk-neutral implied skewness and kurtosis (*à la Bakshi et al.*)

Following the methodology of Dennis and Mayhew, empirical calibration of the skewness and kurtosis contracts through trapezoidal approximation

### 5. Pseudo-distribution of option prices (*à la... nobody else*)

Every month, the OTM put and call option prices display a different pattern as a function of their strike price. Once pasted and smoothed, identify several characteristics of the pseudo-distribution:

- Center of gravity (relative to index price)
- Coefficient of variation
- Skewness
- Kurtosis

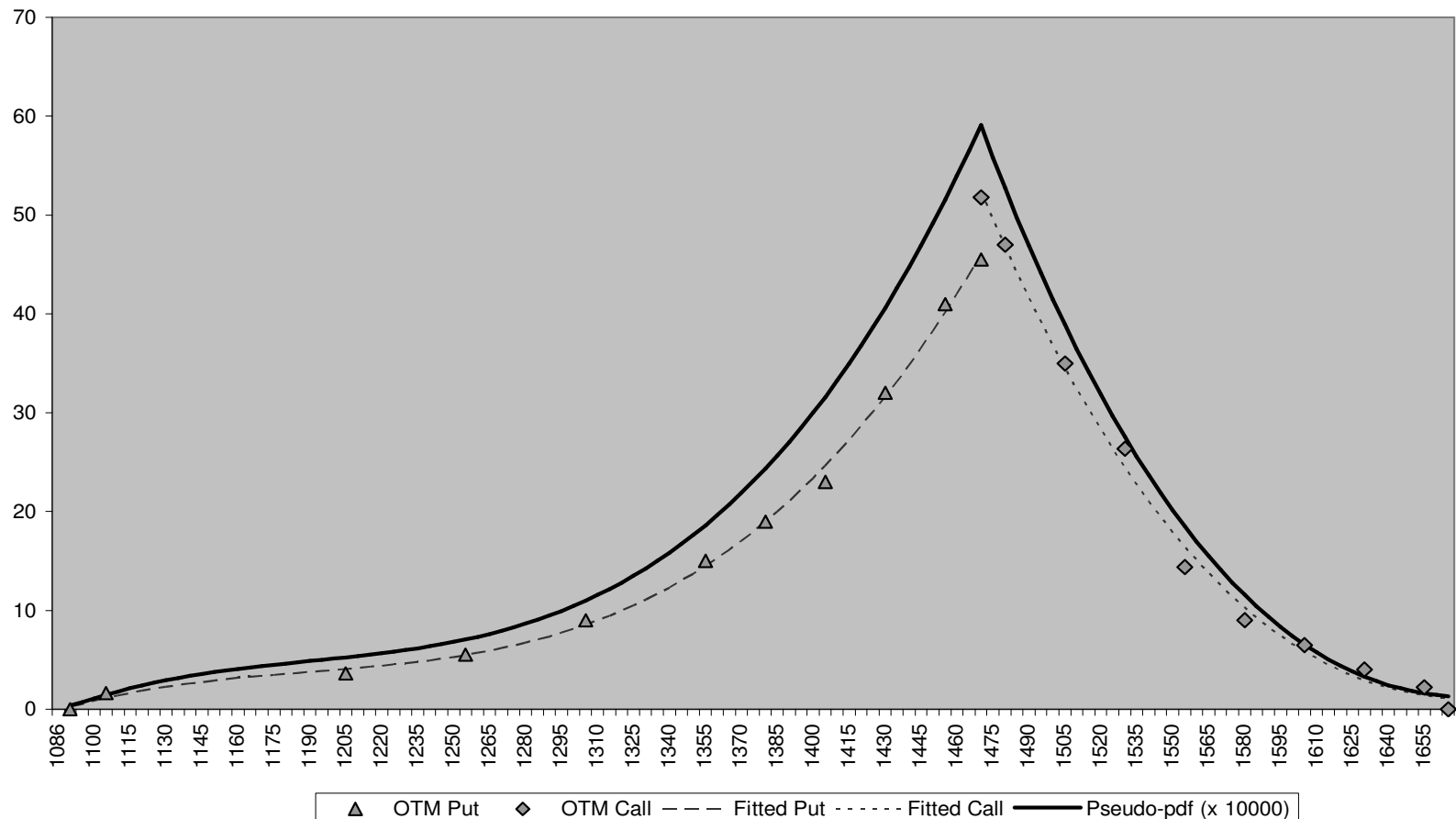
### 6. Lagged option return

Use the lagged artificial option return as a proxy for market timing

# Methods for inclusion of optional and conditional risk premia

## Optional factors (cont'd)

- Illustration of the pseudo-distribution  
OTM option series on the S&P500, maturity June 2000, calibrated on April 27, 2000



Edhec Hedge Fund Days 2006

# Performance of pricing models

## Non-optional and instrumental factors

	Funds of Funds	Non-Directional		Directional				
		Event Driven	Market Neutral	Global Macro	Short sellers	Long only	Global Emerging	Sector
<i>Factors</i>								
EMBI	+	+	+	+		+	+	
RUS	+	+	+	+	-	+		+
SMB	+	+	+	+	-	+	+	+
HML		+	+		+			
UMD	+			+	-			+
NBER	-							
GOV				+			-	
WXUS				+				
<i>Instruments</i>	3	4	2	1	3	2	2	3
<b>Adj. R<sup>2</sup></b>	<b>73.7%</b>	<b>80.5%</b>	<b>66.6%</b>	<b>71.5%</b>	<b>79.4%</b>	<b>83.5%</b>	<b>63.8%</b>	<b>90.4%</b>
<b>≠ pure factor</b>	<b>+4.8</b>	<b>+7.9</b>	<b>+8.1</b>	<b>+1.2</b>	<b>+2.0</b>	<b>+1.9</b>	<b>+4.2</b>	<b>+3.7</b>

# Performance of pricing models

## Optional factors

	Funds of Funds	Non-Directional		Directional				
		Event Driven	Market Neutral	Global Macro	Short sellers	Long only	Global Emerging	Sector
VIX		-		-		-		
OTM Call							+	
ATM Call	+	+	+	+	-	+		+
ATM Put	-	-	-	-	+	-	-	-
RN Skew	+			+	-			
Ps. Skew					-			
Ps. Kurt	-	-		-		-		-
Lag ATMP	-	-	-				-	
Lag OTMC								+
<b>Adj. R<sup>2</sup></b>	<b>50.3%</b>	<b>62.4%</b>	<b>44.3%</b>	<b>50.0%</b>	<b>56.0%</b>	<b>70.1%</b>	<b>37.8%</b>	<b>60.5%</b>

# Performance of pricing models

## Optimal set of factors

<b>Factors</b>	Funds of Funds	Non-Directional		Directional				
		Event Driven	Market Neutral	Global Macro	Short sellers	Long only	Global Emerging	Sector
EMBI	+	0	+	+		+	+	
RUS	+	+	+	+	0	+		+
SMB	+	+	+	+	-	+	+	+
HML		+	+		0			
UMD	+			+	-			+
NBER	0							
GOV				+			-	
WXUS				0				
<i>Instruments</i>	<b>2 (-1)</b>	<b>3 (-1)</b>	<b>3 (+1)</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>
<i>Options</i>								
VIX		0		0		0		
OTM Call	-	-	-		-		0	-
ATM Put	+	+	+	0	0	-	+	0
OTM Put			+	+		+		
RN Skew	0		+	+	-			
Ps. Rel strike				+				+
Ps. Coef var	+		+	+				+
Ps. Skew			+		0			
Ps. Kurt	-	0		-		0		-
Lag ATMC	-	-	-			-	-	-
Lag OTMP				-				
<b># factors</b>	<b>11 (+3)</b>	<b>9 (+1)</b>	<b>14 (+8)</b>	<b>12 (+5)</b>	<b>7 (+0)</b>	<b>8 (+3)</b>	<b>7 (+2)</b>	<b>11 (+5)</b>
<b>Adj. R<sup>2</sup> (≠ pure factor)</b>	<b>79.1 (+10.2)</b>	<b>85.2 (+12.6)</b>	<b>74.5 (+16.0)</b>	<b>73.9 (+3.6)</b>	<b>81.4 (+4.0)</b>	<b>87.1 (+5.5)</b>	<b>66.2 (+6.6)</b>	<b>92.2 (+5.5)</b>

Edhec Hedge Fund Days 2006

# Performance of pricing models

## Optimal set of factors (cont'd)

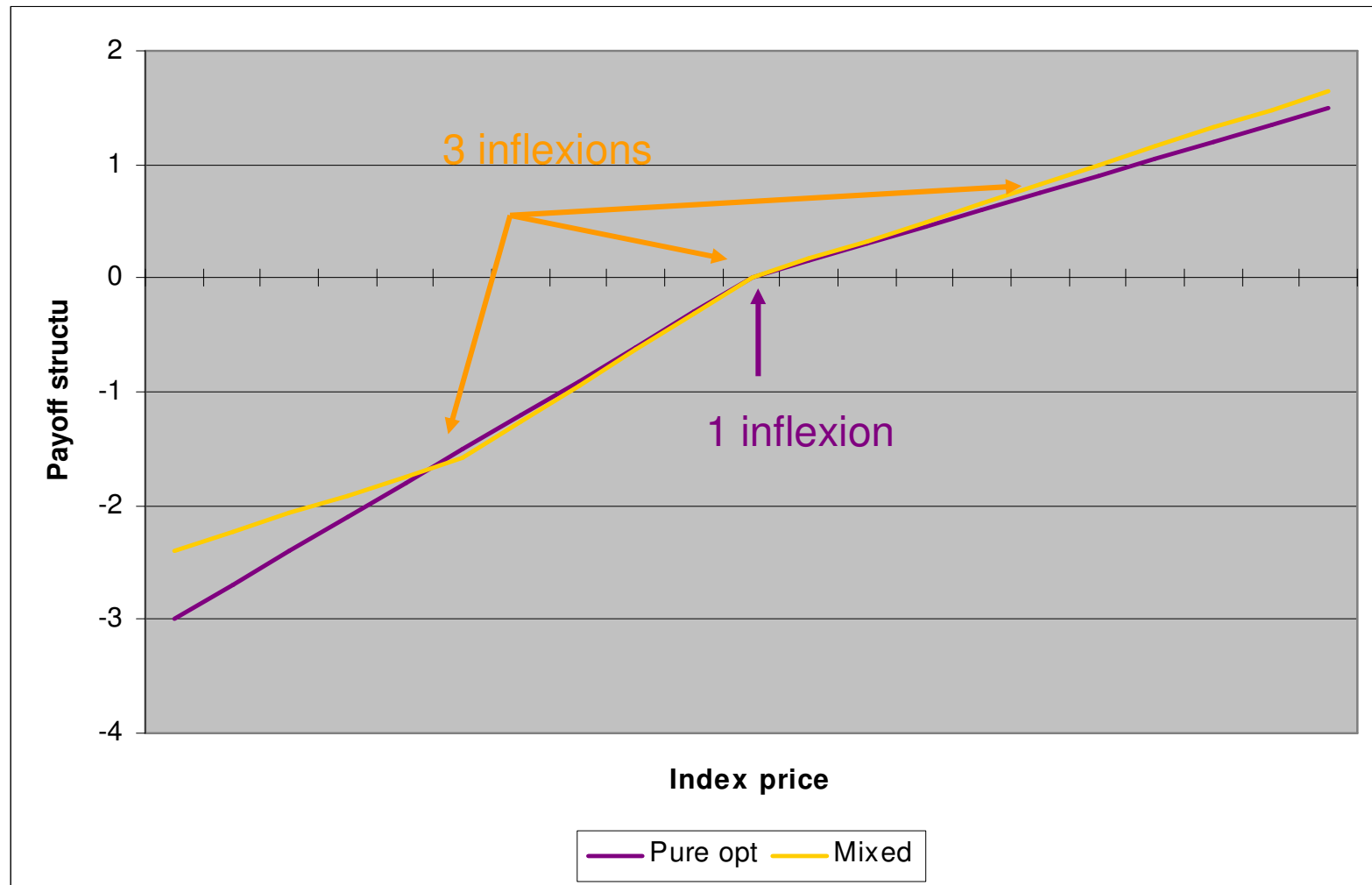
---

- Summary of results:
  - The introduction of instruments options works best for non-directional strategies
  - The complexity of Funds of funds, Event Driven and Market Neutral strategies is well tackled; not that of Global Macro and Emerging
  - Three factors disappear (NBER, WXUS and VIX)
  - The option return factors (simultaneous and lagged) change when combined with non-optional factors (especially EMBI and RUS); the signs change as well: evidence that Index – OTM Call + Put outperforms  $x$  Calls -  $y$  Puts (see next slide)
  - Five specifications remain parsimonious (from +0 to +3 factors) but Market Neutral specification explodes (+8 premiums to 14 factors!)
  - For the persistence study, we keep the following specifications:
    - For Funds of funds: 11 factors (4 non-opt, 2 instr, 5 optional)
    - For Non-directional: 13 factors (4 non-opt, 4 instr, 5 optional)
    - For Directional: 14 factors (5 non-opt, 3 instr, 6 optional)

# Performance of pricing models

## Optimal set of factors (cont'd)

- Example: payoff for the Risk Neutral strategy



# Persistence analysis in bull and bear markets

## Methodology

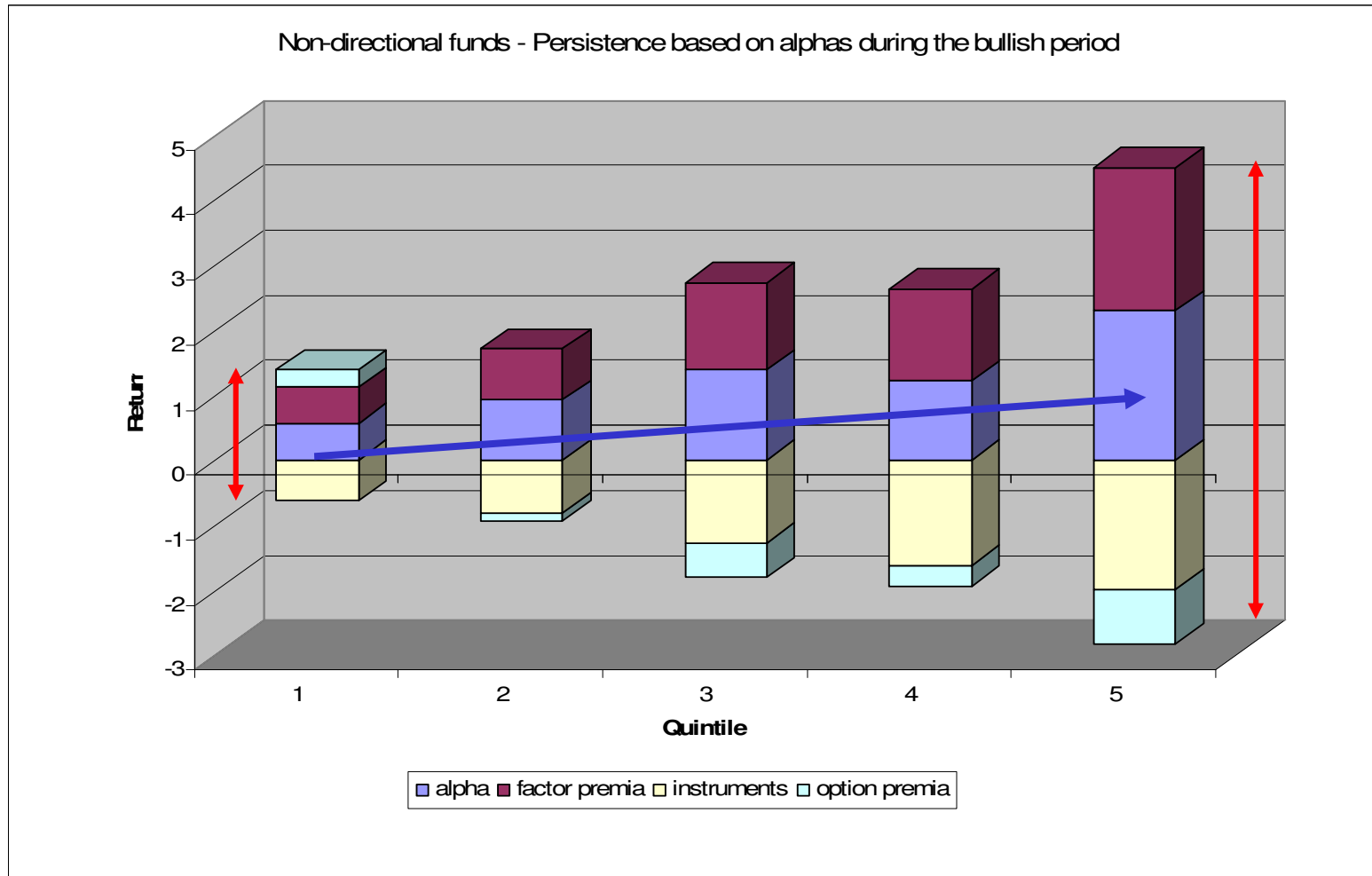
---

- Persistence analysis:
  - For each strategy, select the funds that showed 24 consecutive returns until 1997:12 (for persistence in the bullish period) and until 2000:06 (for persistence in the bearish period)
  - Run the pricing model on individual funds for the past 48 months
  - Classify funds in quantile portfolios on the basis of
    - Average total return
    - Alpha
    - Generalized Treynor Ratio (i.e. alpha divided by average return – alpha, if positive)
  - When a fund disappears, the proceeds are reinvested in the remaining funds
  - Run the model on the portfolios and look at alphas
  - Three questions:
    - Is there persistence based on one performance measure ?
    - If yes, is it robust from the bullish to the bearish period ?

# Persistence analysis in bull and bear markets

## Results

- Non-directional funds (bullish markets):

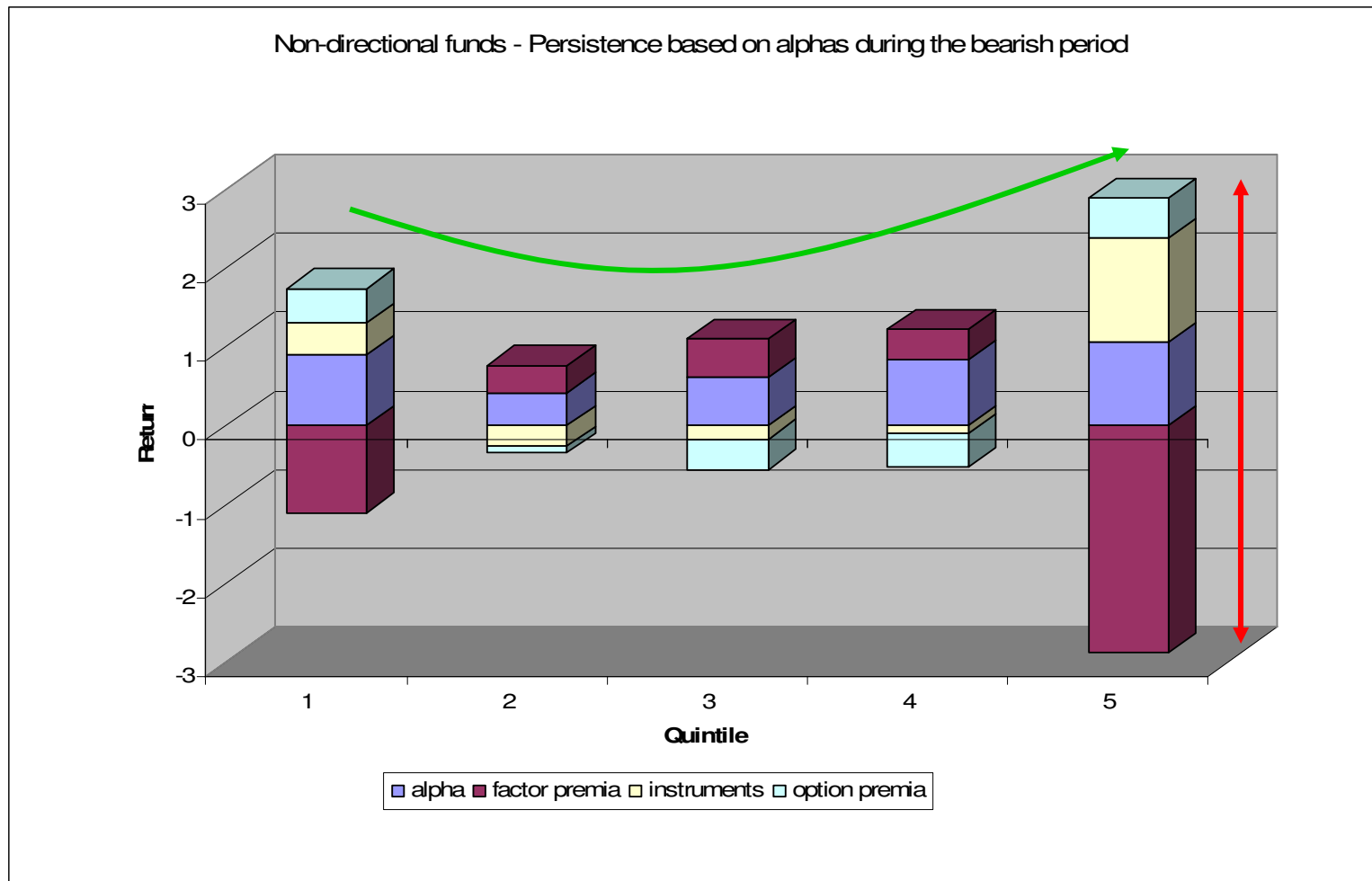


- Alphas increase
- Risk exposures widen
- Factor premia tend to compensate instrumental premia
- Very small total option premia

# Persistence analysis in bull and bear markets

## Results (cont'd)

- Non-directional funds (bearish markets):

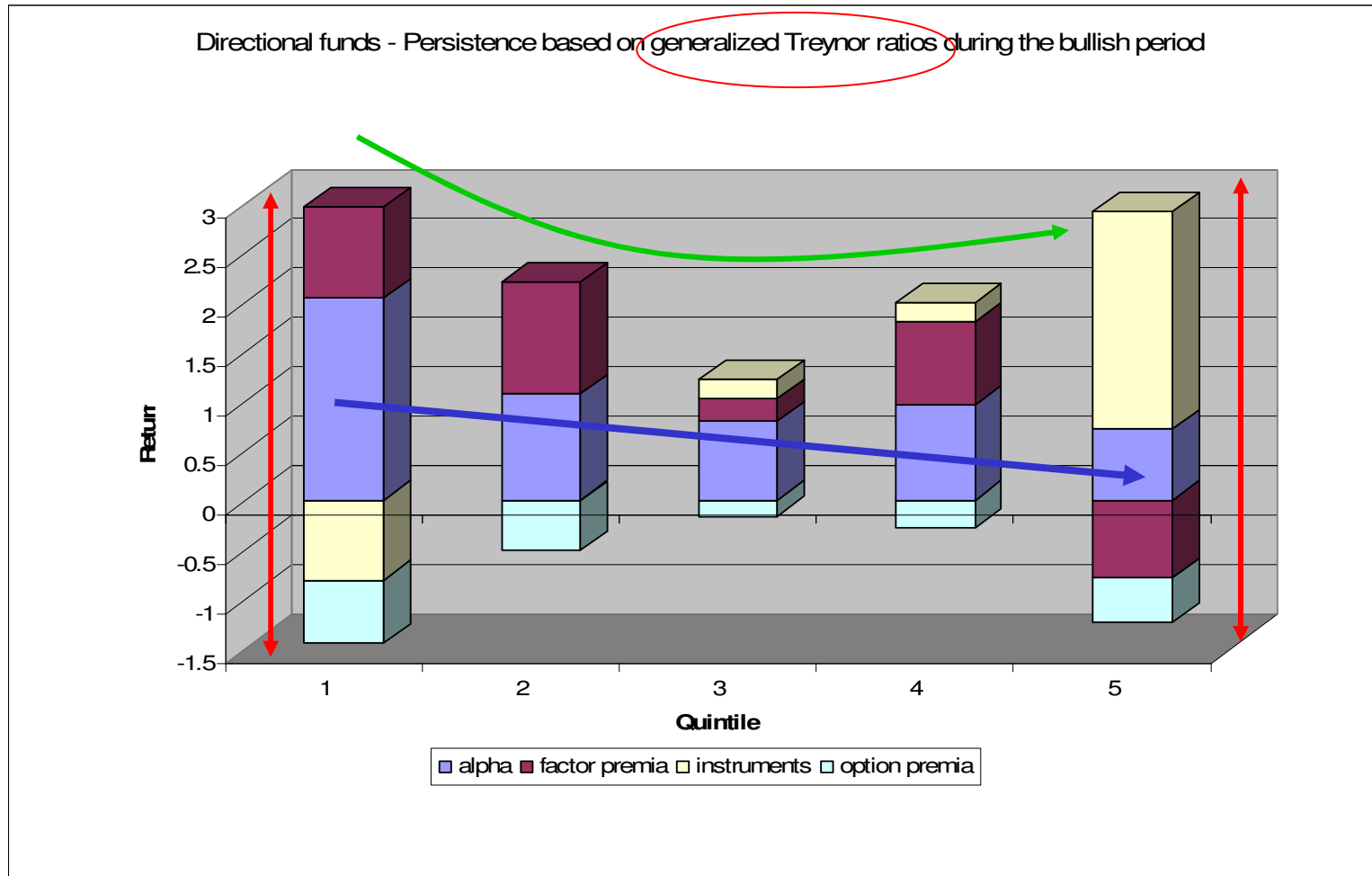


- Alphas do not differ
- Risk exposures large for Q1 and Q5
- Middle quintiles have the same exposure as in bullish market
- Extreme quintiles have reversed their exposure

# Persistence analysis in bull and bear markets

## Results (cont'd)

- Directional funds (bullish markets):

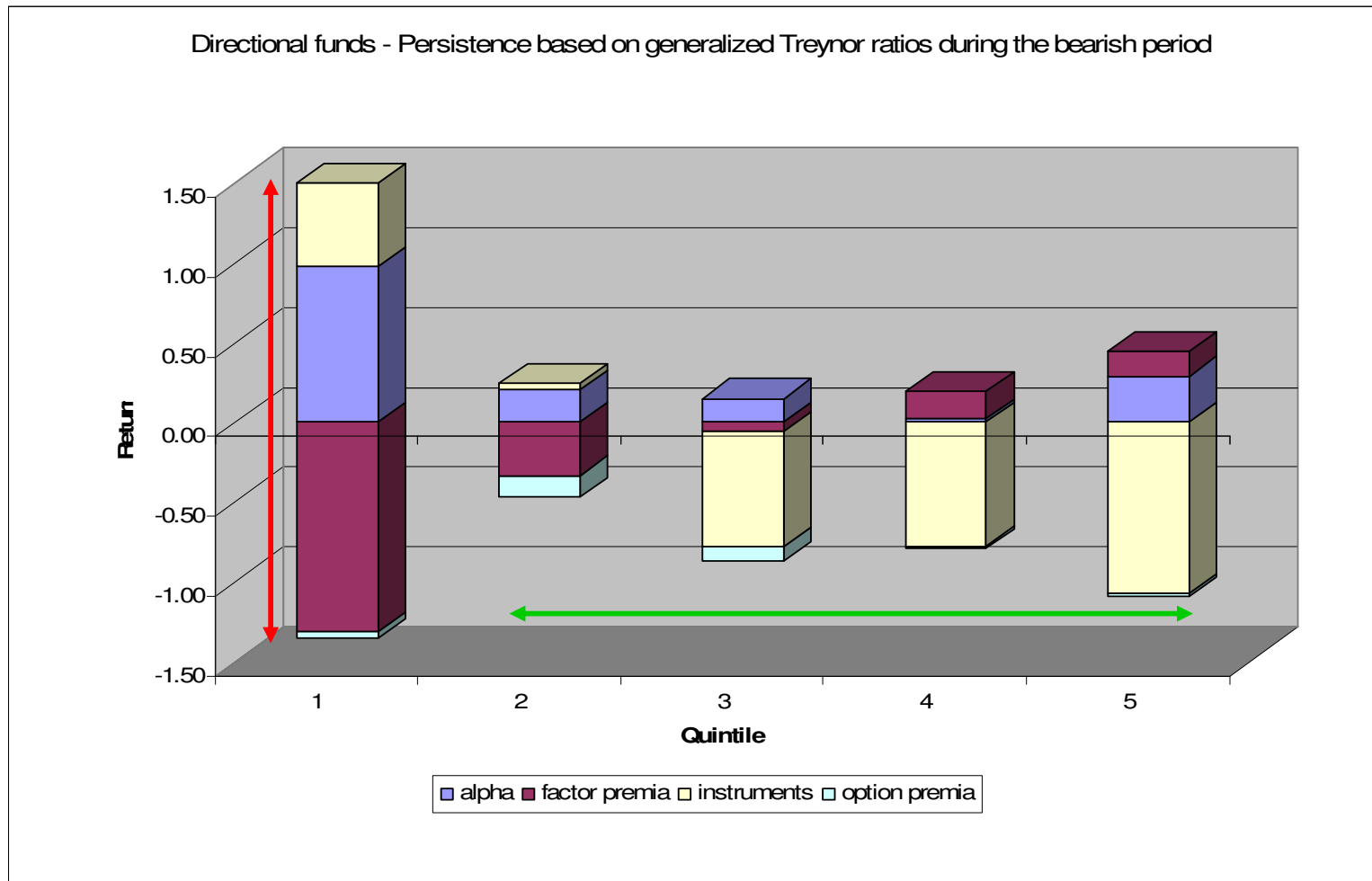


- Generalized Treynor ratio selects out the funds with low required returns
- Alphas decrease
- Risk exposures large for Q1 and Q5
- Top quintile has an exposure opposite to the others (large option premium)

# Persistence analysis in bull and bear markets

## Results (cont'd)

- Directional funds (bearish markets):

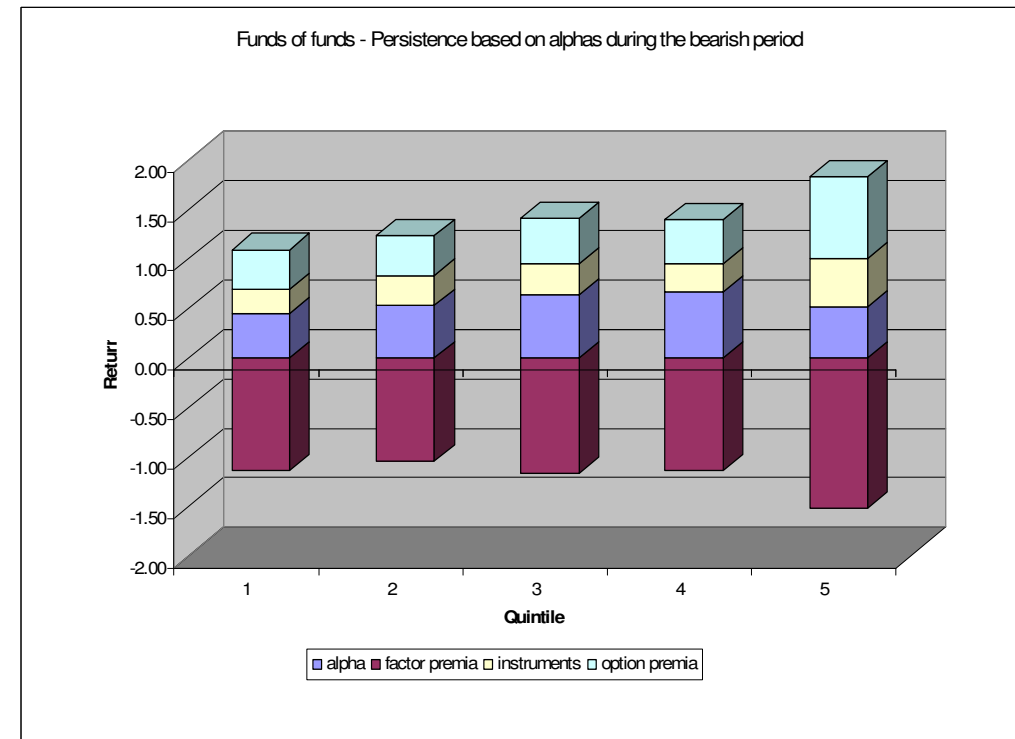
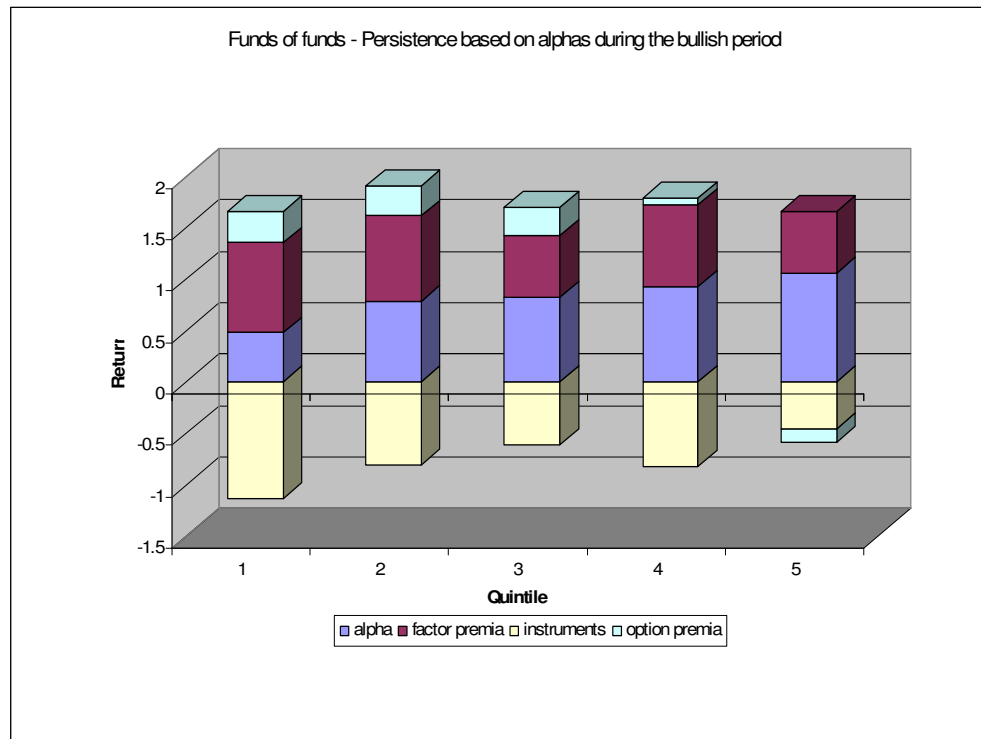


- Alphas only positive and signif. for Q1
- At the expense of large risk exposure
- Bottom quintile has an exposure opposite to the others (large option premium)
- The exposures are opposite to the bullish period

# Persistence analysis in bull and bear markets

## Results (cont'd)

- Funds of funds :



- Very similar pattern for bullish and bearish market (opposite for non-optional and instrumental premiums)
- Alphas trend up in bullish, no trend in bearish market

# Conclusion

---

- Optional and (to an even greater extent) instrumental components have been underexploited in previous research on hedge funds
- Three directions are promising:
  - Returns from option strategies that account for the timing abilities (most studied part)
  - Moments extracted from option prices. Rarely studied; much remains to be done
  - Lagged option returns accounting for market sentiment. Their explanatory power is striking
- There is evidence of persistence, especially contrarian for directional funds
- Unanswered question (so far): would there be evidence of persistence with only non-optional factors ?
  - part of our research agenda...

*The paper will be available on the EDHEC-Risk website in March*