An Introduction to Alternative Risk Premia

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Investors can apprehend the ARP universe from two angles. The first one is the academic literature on risk factors, from which they have been developed. The second one is the information communicated by ARP providers, which are essentially operational research documents, commercial presentations, and two-pagers describing the individual ARP strategies they offer. If the academic literature has the drawback of being purely theoretical, the documentation provided by asset managers and investment banks is heterogeneous and often specific. It is therefore difficult for investors to have a global vision of the industry. What are the ARP strategies offered by investment banks? How are they constructed? What are their specific statistical properties? What issues should be addressed in a sound selection / investment / risk management process?

In the first part, we retrace the link between academic factors and ARPs. Through the analysis of their operational implementation process, we show that – contrary to what we would expect – ARPs aiming to replicate similar factors can show significant heterogeneity. We then discuss the frontier between academic ARPs and trading ARPs, as well as their positioning in the factor investing industry and in the alternative investment universe.

In the second part, we analyze the features of the current ARP offering from a proprietary database, that combines the current offering of 9 investment banks (more than 400 ARP). It turns out that only one half of the investable ARPs are academic premia, the other half of the offering being composed of trading risk premia, which aim to capture market anomalies or to replicate hedge fund strategies.

Finally, we analyze the statistical properties of 293 ARPs over the period 01/05/2007 – 09/07/2018. Our results put forward an attractive risk-return profile in different market configurations, with the counterpart of increased extreme risks (non-Gaussian returns), especially for trading ARPs. Second, the analysis of their correlation structure shows significant diversification properties, between ARPs and other asset classes, between the various ARPs strategies, and more surprisingly between ARPs based on the same risk factors.

To conclude, we highlight the issues that arise from their specific features, both qualitative and quantitative, and that must be addressed by investors.

From Academic Risk Premia to the Current ARP Offering

ARPs are systematic, rule-based investment strategies, aiming to harvest risk premia delivered by exposures to systematic risk factors, that have been extensively documented in the academic literature (value, quality, momentum…). Investment banks put forward this connection with the academic universe, as the main argument in their marketing approach. However, the analysis of investable ARPs shows that they can significantly differ from the risk factors identified in the academic literature, for two reasons. First, as the implementation process of risk premia has not been addressed by academics, investment banks follow their own one, that can diverge from each other. Second, they incorporate trading (i.e. non-academic) risk premia in their ARP offering, which objective is to exploit market anomalies, rather than risk factors exposure.

Academic Risk Factors and Academic Risk Premia

Since the seminal work of Fama and French (1992), the theme of risk factors has developed strongly within the academic community, with the objective to explain the cross-sectional returns of the various asset classes. Roughly, these factors are designed as market neutral or dollar neutral[1] portfolios to capture the orthogonal[2] performances and risks generated by the exposures to specific features (or economic factors) of the underlying securities, such as their quality or valuation level. They are formed of a long and a short portfolio, respectively formed of securities that exhibit the highest and lowest exposure level to the underlying economic factor (e.g., long high-quality stocks vs. short low-quality stocks in the quality factor).

From then, many academics focused the research on factors showing an ability to generate robust long-term performance, (i.e. a risk premium) around the theme of factor investing. Risk premia are then considered as systematic quantitative investment strategies, relegating the original objective of risk factors[3] to the background. Exhibit 1 provides a non-exhaustive list of the main risk premia documented in the academic literature.

Risk premia	Economic intuition	Implementation	Asset classes	References
Value	Benefit from the price convergence between undervalued and overvalued assets. The relative value of a security is evaluated by an economic measure (price to book ratio for the shares, PPP for the currencies ...)	Buy undervalued securities, sell over-valued securities.	Equities, rates, credit, FX, commodities.	Fama et French (1992, 1993); Asness, Frazzini (2013); Asness, Moskowitz, Pedersen (2013).
Momentum	The momentum premium is based on a behavioral bias: demand for securities with the best recent performance tends to be larger than demand for securities with weaker recent performance.	Long positions in the best- performing stocks, short positions in the least performing stocks.	Equities, rates, credit, FX, commodities.	Jagadeesh et Titman (1993); Carhart (1997); Rouwenhorst (1998); Moskowitz and Grinblatt (1999); Asness, Moskowitz, Pedersen (2013).
Low risk, low beta, low volatility...	According to the CAPM theory, investors who cannot use leverage are forced to allocate their assets in a non-optimal manner, over-allocating to riskier stocks. This generates a market anomaly that, overall, is beneficial to the least risky securities (less susceptible to market corrections).	Long positions on the least risky stocks, short positions on the riskiest stocks.	Equities, rates, credit, FX, commodities.	Ang, Hodrick, Xing, Zhang (2006); Ang, Hodrick, Xing, Zhang (2009); Frazzini and Pedersen (2014).
Carry	Benefit from the yield differential (rates, coupons, dividends, etc.) between similar assets.	Long positions in high yield securities, short on low yielding ones.	Equities, rates, credit, FX, commodities.	Koijen, Moskowitz, Pedersen, Vrugt (2016); Gorton, Hayashi, Rouwenhorst (2012); Brooks, Moskowitz (2017).
Quality	Benefit from the outperformance of companies that show superior quality, in terms of profitability, dividend distribution, credit quality, governance ...	Long high quality compagnies, short low quality compagnies.	Equities.	Greenblatt (2006); Asness, Frazzini, Pedersen (2013); Novy-Marx (2014).

Exhibit 1: Main Risk Premia Identified in the Academic Literature
Source: Orion Financial Partners

The Implementation of ARPs: from Theory to Practice

Academic risk factors are purely theoretical, in the sense that they are not directly investable. Indeed, many operational parameters – such as the liquidity of the underlying securities, the possibility of selling them short, transaction costs – are not considered in their construction. This is where alternative risk premiums take over: they are investable versions of academic risk premia.

Although the economic factors involved in the construction of academic premia are well documented in the literature, the absence of clear guidelines leaves a significant margin in their operational implementation. It appears that ARPs aiming to replicate the same academic premium can show significant divergences between each other (i.e., a relatively low correlation), but also with the academic factor they aim to replicate. These divergences find their source at different levels in the ARP construction process, which can be summarized around the steps detailed below.

Step 1: The definition of the investment universe consists in identifying all the securities – most often within a given market benchmark – to which the strategy will be applied. The universe will be jointly determined by common criteria (liquidity, market capitalization…) and more discretionary criteria, specific to certain providers. In that case, their investment universe may exclude securities that have recently had "excessive" volatility, securities that are subject to specific market situations (takeover bids, etc.) or securities belonging to a specific sector (notably banking).

Step 2: The definition of economic factors and their measures. The construction of certain academic factors leaves little room for interpretation. For example, this is the case of the size factor whose only measure is the market capitalization of companies. But in other cases, there is no real consensus in the literature about the criteria that should be used to define the factors. This is particularly true for the quality factor, which is based on the identification of profitable, operationally efficient, and low-risk companies, whose governance is sound and stable. This wide definition leaves room for interpretation, and results in heterogenous measures this factor. For example, Novy-Marx (2013) measures the quality of a company by its gross profit / gross asset ratio as the main measure of quality, whereas Piotroski (2000) or Asness, Frazzini and Pedersen (2013) combine different measures and criteria to define this factor.[4]

Step 3: Scoring consists in measuring the exposure level of the securities to the risk factors. The scores generally take the form of an aggregation of the various measures of the underlying factor into a z-score.

Step 4: The classification and selection step consists in identifying the securities that will enter the composition of the long and short portfolios. The construction of academic factors is generally based on the classification of the investment universe into three groups, according to their respective scores. The group composed of the securities with the highest (worst) scores will compose the long (short) leg of the portfolio. The group composed of the securities with intermediate scores is excluded from the construction of the factor. If there is no consensus on the size of the groups, the top and worst groups must be of equivalent size (long top 10% vs. short worst 10%, long top 25% vs. short worst 25% ...). Tighter groups naturally imply less diversification and a significant increase the impact of both specific selection criteria and model risk.[5]

Step 5: The construction of long and short portfolios is a key step in the construction of ARPs. In the academic literature, there is no consensus on the weighting method to use. For example, int the size and value factors of Fama and French (1992) or in the quality factor of Asness, Frazzini and Pedersen (2013), the security's weights are determined by their market cap. In Frazzini and Pedersen (2014), the weight the securities in the BAB (betting against beta) factor is defined by their exposure to market risk (beta). In the ARP offering of investment banks, we have identified many simple[6] or optimized[7] allocation methods. It is important to point out that in practice, the short leg of the factor's portfolios is often replaced by a short exposure in the benchmark future contract. This point marks a real divergence between ARPs and academic factors. This substitution of the short portfolio by a future position can be justified by the research of cost efficiency, or by the potential liquidity management issues that may arise from short sales.

Step 6: The long/short allocation methodology defines the orthogonality, i.e. the market neutrality, of ARPs. In the literature, academic risk factors can alternatively be defined as portfolios that are equally allocated between the long and the short leg (sum of the weights equals zero, dollar neutral portfolios), or as market neutral portfolios constructed to neutralize exposure to market risks (beta neutral). In practice, equity, rate, and credit ARPs tend to be structured as market neutral strategies (with null beta for equities, null duration for rates and credit), whereas the long and short legs of commodity and FX ARPs tend to be dollar neutral.

Step 7: The level of leverage employed in the investment strategy can substantially vary, depending on the risk management policy of the ARP (target volatility level vs. fixed ad hoc risk constraints).

Almost all the steps listed above leave significant freedom in the implementation process of ARPs. Consequently, ARPs proposed by different providers with the aim of capturing the same risk premium, can show significant differences in their portfolio composition and, ultimately, show relatively low levels of correlation. This may be especially the case when the investment universes are similar, but not identical. For example, two European equity momentum ARPs, whose universes are respectively the Eurostoxx 50 and the Stoxx 600, will probably have only a marginal number of common stocks in their allocations.[8] Furthermore, differences in factor definitions, classification thresholds, or weighting and allocation methodologies will have an impact on both the constituents and the allocation of the long and short leg of ARP portfolios.

To summarize, as the operational implementation of theoretical risk premia have not been addressed by academics, ARPs which display apparently similar strategies can indeed display very specific features and deliver significantly heterogeneous performances. Some providers could see in this freedom of implementation the opportunity to fine tune the parametrization

of their ARPs, in order to differentiate from external offering, or to enhance the risk/return characteristics[9] of the backtested strategies.

The Frontier Between Academic Risk Premia and Trading Risk Premia

We distinguish two types of ARPs in bank's offering. Academic ARPs are directly aimed to replicate the risk premia presented in Exhibit 1. They are based on factors that have been well documented in the academic literature, and that essentially involve the trading of listed and liquid products. Backed by academic research, academic ARPs are expected to be resilient in various market configurations and in the different phases of the economic cycle.

On their side, trading ARPs (listed in Exhibit 2) encompass a set of systematic and rule-based quantitative investment strategies, that alternately aim to replicate hedge fund strategies (trend following, M&A…) or to exploit market anomalies, whose economic rationale may be hard to apprehend. Unlike academic ARPs, trading ARPs are mostly backed by applied research, academic research being limited by data availability (especially in the case they rely on the trading of OTC derivatives) or by the lack of theoretical foundations. They also differ from academic ARPs in their construction process. They are not necessarily market neutral,[10] and may be based on a more discretionary stock selection process.[11] They also generally incorporate more parameterization, which can potentially increase model risk and imply a disconnection between the behavior of the strategy between the backtest and the live period.[12]

Overall, these differences do not prejudge the potential of over- or underperformance of trading ARPs vs. academic ARPs. But they must be considered in the selection, in the investment, and in the risk management processes.

ARP, Factor Investing and Hedge Funds

The purpose of factor investing is to tilt the allocation of investment portfolios towards specific factors, in order to add a layer of performance and diversification from systematic risk premia. The universe drawn by this definition is quite broad. It encompasses many heterogeneous investment strategies, which can be traditional (long only) or alternative (long/short, market neutral), active or passive. systematic (often) or discretionary[13] (more rarely).

During the last decade, smart beta strategies have been the main development vector for the factor investing industry. Roughly, these are traditional investment strategies,[14] whose allocation process aims to overweight securities with specific features (factor exposure) with the objective to enhance their risk-return profile by capturing particular risk premia. But the contribution of risk premia in their overall performance remains limited (if not marginal) as their regulatory environment (mutual funds, ETFs) imposes strong investment constraints (long only, no leverage, no short sales…), and therefore limit factor exposures.

ARPs can be viewed as the "alternative" evolution of smart beta strategies, with the objective of delivering pure (instead of marginal) factor exposure. Their alternative nature comes from the joint use of short positions, leverage, and derivatives (future contracts in most cases). Consequently, the border between ARPs and hedge funds (especially quantitative hedge funds) may seem blurred, as they require similar investment techniques and instruments. There are, however, fundamental differences between these two universes. First, ARPs aim to capture the risk premia from risk factors, whereas hedge funds aim to generate alpha in a

Risk premia	Economic intuition	Implementation	Asset classes	Academic references
Short volatility	The structural demand for protection implies a structural difference between the levels of implied (higher) volatility and realized volatility.	Short straddle, delta hedged by a long position in the underlying market.	Equities, rates, credit, FX, commodities.	Coval, Shumway (2001); Ang, Israelov, Sullivan, Tummala (2018)
Volatility carry	Profit from the teem structure of the volatility curve.	Short volatility future (delta hedged) when the curve is in contango. Reverse position when the curve is in backwardation.	Volatility	
Mean reversion	Exploit short-term market overreaction, generally measured by the difference between short (daily) realized volatility and longer-term volatility (one or two weeks).	Long or short position in the underlying index in order to replicate the market sensitivity (delta) induced by a variance swap.	Equities, rates, credit, FX, commodities, volatility.	Poterba, Summers (1988)
Trend following / absolute momentum	Exploit trends in asset prices, similar CTA strategies.	Long positioning on securities with positive trend and/or short ones with negative trend. Directional strategy (long or short bias).	Equities, rates, credit, FX, commodities, volatility.	Moskowitz, Ooi, and Pedersen (2012); Fung, Hsieh (2001)
Directional versions of academic ARPs	Cf. **Table 1**.	Long and/or short positions on the securities from the investment universe, defined by their exposure level to the underlying risk factor.	Equities, rates, credit, FX, commodities.	Cf. references in **Table 1**.

Exhibit 2: Main Trading Risk Premia Identified in the Offering of Investment Banks
Source: Orion Financieal Partners

broader sense, via factor exposures, but also (and mainly) to more specific risk premia. In that sense, hedge funds are not part of the factor investing universe. Second, the strategies implemented in ARPs are systematic and based on strict investment rules, whereas those of hedge funds are more discretionary and managed in a more flexible framework. Finally, ARPs offer significantly higher levels of transparency and liquidity than hedge funds, for a lower cost structure.

Typology of the ARP Offering

We present the features of the current market offering, from a proprietary database of more than 350 investable ARP indices provided by 9 investment banks.[15]

Classification and Distribution of Strategies

As far as we know, there is no standard classification of ARPs. The different providers generally differentiate them according to three dimensions: the underlying asset class, the underlying risk factor, and the geographical focus. However, academic ARPs and trading ARPs are generally not dissociated and are merged in their offering. We propose a classification based on four dimensions: the previous three dimensions to which we add the nature of ARPs (academic or trading). The typology of the investment universe referenced in our database is detailed in Exhibit 3. It appears that:

- Less than one half of the ARPs offered by investment banks are academic ARPs.
- 46% of ARPs are focused on equity markets, 18% on currencies, 15% on interest rates, 15% on commodity markets, and a little 5% on credit.
- The offering of academic ARPs is significantly concentrated on equity markets (60%), and to a lesser extent on the FX markets (20%). It remains marginal for other asset classes. Conversely, the supply of trading ARPs is more heterogeneous among the various asset classes.
- Almost 90% of academic ARPs are focused on academic factors (carry, value, momentum, quality, and low risk), whereas trading ARPs are more concentrated on short volatility (29%), trend (24%), and carry (17%) strategies.

Nature	Factor	Underlying asset class: Equities	FX	Credit	Rates	Commos	Total
Academic ARPs	Carry	1.7%	7.7%	1.7%	2.6%	2.0%	15.6%
	Growth	0.3%	0.0%	0.0%	0.0%	0.0%	0.3%
	Liquidity	0.3%	0.0%	0.0%	0.0%	0.0%	0.3%
	Low risk	5.7%	0.0%	0.0%	0.0%	0.0%	5.7%
	Mean reversion	0.6%	0.0%	0.0%	0.0%	0.0%	0.6%
	Momentum	5.7%	0.6%	0.0%	0.3%	0.6%	7.1%
	Profitability	1.4%	0.0%	0.0%	0.0%	0.0%	1.4%
	Quality	4.5%	0.0%	0.0%	0.0%	0.0%	4.5%
	Size	2.8%	0.0%	0.0%	0.0%	0.0%	2.8%
	Value	6.5%	2.0%	0.0%	0.9%	0.6%	9.9%
	Total	29.5%	10.2%	1.7%	3.7%	3.1%	48.3%
Trading ARPs	Carry	1.7%	0.0%	1.1%	3.1%	3.1%	9.1%
	Liquidity	0.0%	0.3%	0.0%	0.0%	2.3%	2.6%
	M&A	1.1%	0.0%	0.0%	0.0%	0.0%	1.1%
	Mean reversion	1.4%	1.1%	0.0%	0.0%	0.0%	2.6%
	Momentum	0.0%	0.3%	0.0%	0.3%	0.6%	1.1%
	Trend	1.4%	3.1%	2.3%	3.7%	1.7%	12.2%
	Value	0.0%	0.3%	0.0%	0.0%	0.3%	0.6%
	Long volatility	0.6%	0.0%	0.0%	1.1%	0.0%	1.7%
	Short volatility	5.7%	2.8%	0.3%	2.6%	3.7%	15.1%
	Volatility carry	1.4%	0.0%	0.0%	0.9%	0.0%	2.3%
	Volatility trading	3.4%	0.0%	0.0%	0.0%	0.0%	3.4%
	Total	16.8%	8.0%	3.7%	11.6%	11.6%	51.7%
	Total	**46.3%**	**18.2%**	**5.4%**	**15.3%**	**14.8%**	**100.0%**

Exhibit 3: Distribution of the ARP Offering of 9 Investment Banks
Source: Orion Financial Partners

	Equities	FX	Credit	Rates	Commos.	% aca.	% trading	% od global offering
Bank 1	6.8%	2.0%	1.1%	1.4%	1.4%	35.6%	64.4%	12.8%
Bank 2	8.5%	2.0%	1.1%	3.1%	5.1%	44.3%	55.7%	19.9%
Bank 3	7.7%	0.9%	0.0%	1.4%	0.6%	43.2%	56.8%	10.5%
Bank 4	4.3%	2.3%	2.0%	3.4%	4.8%	47.5%	52.5%	16.8%
Bank 5	1.4%	6.0%	0.0%	1.7%	0.0%	59.4%	40.6%	9.1%
Bank 6	0.9%	2.0%	0.6%	1.1%	1.1%	40.0%	60.0%	5.7%
Bank 7	1.4%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	1.4%
Bank 8	12.2%	2.3%	0.6%	2.6%	1.7%	50.0%	50.0%	19.3%
Bank 9	3.1%	0.9%	0.0%	0.6%	0.0%	81.3%	18.8%	4.5%

Exhibit 4: Distribution of ARPs Between the Various Providers
Source: Orion Financial Partners

Distribution of the Offering by Provider

Exhibit 4 summarizes the distribution of the ARP offering among the providers. It appears that (i) the first 3 investment banks[16] deliver 56% of the ARP offering ; (ii) the offering of certain banks is concentrated on specific risk premia, (for instance, bank 9 that offers 81% of academic ARPs, whereas bank 1 offers 65% of trading ARPs); (iii) certain banks are specialized on specific asset classes, like bank 5 which offers 65% of FX premia. This specialization is not surprising, as investment banks will tend to develop ARPs that fall in their expertise field, to benefit from comparative advantage and bring greater added value.

Geographical Distribution

Except for FX and commodity ARPs that have a global focus by nature, ARPs can focus on specific regions or be global. In detail (Exhibit 5), 80% of equity ARPs exhibit a geographical bias (balanced between USA and Europe), whereas more than 50% of interest rate premia have a global focus. Credit ARPs, on the other hand, are more concentrated in Europe (47% of the offer, vs. 21% in the US).

Risk, Return, and Diversification Properties of ARPs

In this section, we present the risk, return, and diversification properties of ARPs, through the analysis of their univariate and multivariate statistical properties. The results reported here are based on the analysis of 273 mono-factor and mono-asset class ARPs (73% of our database), over the period 01/05/2007 – 09/07/2018.

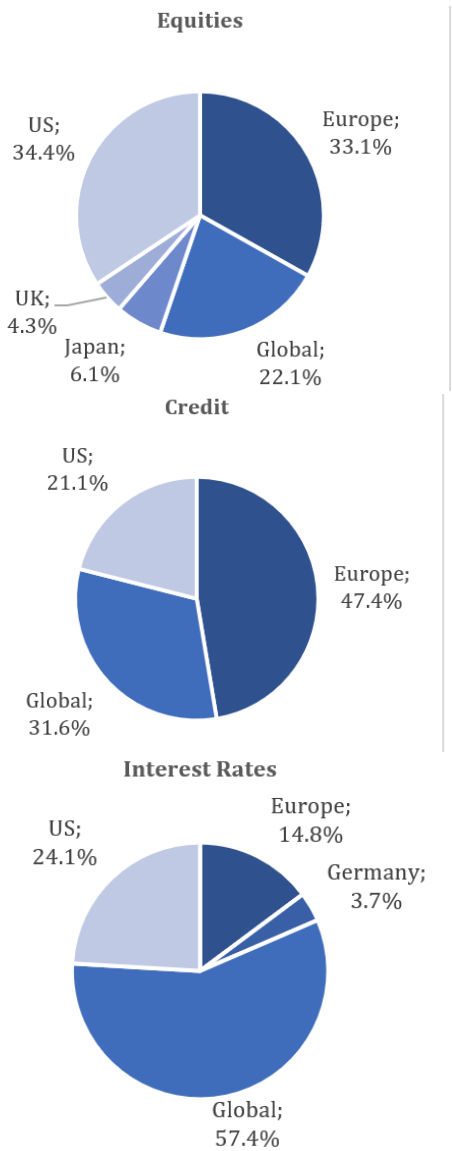


Exhibit 5: Geographic Repartition of Equity, Credit, and Interest Rate ARPs
Source: Orion Financial Partners

ARPs and other assets classes										
	N	**μ**	**σ**	**IR**	**μ+**	**σ+**	**IR+**	**μ-**	**σ-**	**IR-**
ARP	**293**	**3.1%**	**6.6%**	**0.51**	**3.3%**	**5.6%**	**0.58**	**2.4%**	**8.4%**	**0.47**
Equities (1)	-	6.8%	17.8%	0.38	25.1%	12.9%	1.95	-42%	25.9%	-1.63
Bonds (2)	-	3.3%	5.5%	0.61	3.8%	5.2%	0.74	2.1%	6.4%	0.32
Hedge funds (3)	-	0.0%	4.78%	0.00	6.1%	3.9%	1.56	-16%	6.0%	-2.70
Academic ARPs										
Underlying asset	**N**	**μ**	**σ**	**IR**	**μ+**	**σ+**	**IR+**	**μ-**	**σ-**	**IR-**
Equities	102	2.3%	6.1%	0.39	2.1%	5.4%	0.36	3.1%	7.6%	0.50
FX	36	1.4%	8.1%	0.19	4.5%	7.1%	0.62	-7.1%	10.1%	-0.65
Credit	6	2.4%	3.5%	0.68	3.8%	3.0%	1.33	-1.4%	4.7%	-0.32
Rates	13	1.6%	3.8%	0.42	1.4%	3.2%	0.45	2.1%	4.9%	0.45
Commodities	9	6.0%	9.0%	0.72	3.4%	8.4%	0.46	12.9%	10.2%	1.31
Total	**166**	**2.3%**	**6.4%**	**0.38**	**2.7%**	**5.7%**	**0.47**	**1.2%**	**8.0%**	**0.26**
Trading ARPs										
Underlying asset	**N**	**μ**	**σ**	**IR**	**μ+**	**σ+**	**IR+**	**μ-**	**σ-**	**IR-**
Equities	29	5.2%	9.5%	0.54	7.4%	7.4%	0.96	-0.5%	13.3%	0.08
FX	22	3.0%	6.7%	0.44	2.1%	5.6%	0.39	5.5%	8.8%	0.56
Credit	8	4.4%	6.4%	0.66	6.2%	5.5%	1.18	-0.5%	8.4%	-0.14
Rates	36	3.1%	4.4%	0.74	2.3%	3.7%	0.59	5.2%	5.9%	1.14
Commodities	32	5.0%	6.9%	0.89	4.1%	5.9%	0.77	7.4%	8.7%	1.19
Total	**127**	**4.1%**	**6.7%**	**0.68**	**4.1%**	**5.5%**	**0.72**	**4.1%**	**8.9%**	**0.73**

Exhibit 6: Risk-Return Profile of ARPs

Source: Bloomberg, Orion Financial Partners

Notes. μ: average annualized return, σ: volatility, IR: information ratio (μ/σ). Suffixes + and – denote bullish and down periods of the MSCI world index, as defined in Appendix A. Reported statistics are computed over the period 01/05/2007 – 09/07/2018, from weekly data. They are the averages of statistics computed for individual ARPs. (1) MSCI World index (bloomberg: NDDUWI). (2) Bloomberg-Barclays Global Bond Aggregate (bloomberg: LEGATRUU). (3) HFRX Global Hedge Fund index (Bloomberg: HFRXGL).

ARPs and other asset classes							
	N	Skewness (1)	Excess kurtosis (2)	% non-Gaussian Distribution, JB-stat (3)	% non-Gaussian Distribution, BSL-stat (4)	Worst negative choc (standard deviation multiple)	% VaR (99%) crossing (5)
ARP	293	-0.15	7.81	98%	90%	5.47	1.6%
Equities (6)	-	-1.04	9.28	Prob<1%	Prob<1%	8.14	2.0%
Bonds (7)	-	-0.01	1.23	Prob<1%	Prob<1%	3.58	1.1%
Hedge Funds (8)	-	-2.07	11.91	Prob<1%	Prob<1%	8.61	2.8%
Academic ARPs							
	N	Skewness (1)	Excess kurtosis (2)	% non-Gaussian Distribution, JB-stat (3)	% non-Gaussian Distribution, BSL-stat (4)	Worst negative choc (standard deviation multiple)	% VaR (99%) crossing (5)
Equities	102	-0.06	3.87	97%	86%	4.89	1.5%
FX	36	-0.45	6.42	100%	94%	5.76	1.8%
Credit	6	-0.50	5.78	100%	100%	5.68	2.4%
Rates	13	-0.24	7.77	100%	69%	5.53	1.5%
Commodities	9	0.04	1.51	100%	44%	4.00	1.4%
Total	166	-0.17	4.67	98%	85%	5.11	1.6%
Trading APRs							
	N	Skewness (1)	Excess kurtosis (2)	% non-Gaussian Distribution, JB-stat (3)	% non-Gaussian Distribution, BSL-stat (4)	Worst negative choc (standard deviation multiple)	% VaR (99%) crossing (5)
Equities	29	-0.86	25.80	100%	100%	7.94	1.9%
FX	22	0.04	12.39	100%	95%	6.15	1.5%
Credit	8	0.14	5.65	100%	100%	5.12	1.8%
Rates	36	-0.07	7.36	100%	100%	5.47	1.7%
Commodities	32	0.32	5.72	94%	88%	4.71	1.6%
Total	127	-0.12	11.92	98%	96%	5.94	1.7%

Exhibit 7: Highter Moments, Normality tests and extreme Risks

Source: Bloomberg, Orion Financial Partners

Notes. Reported results are the averages of the statistics computed for individual ARPs, over the period 01/05/2007 – 09/07/2018, from weekly data. (1) Asymmetry coefficient. When negative, occurrence probability of extreme losses is higher than for extreme gains. (2) When excess kurtosis is significantly positive, the probability of extreme events is higher than, in the gaussian case. (3) % of ARPs for which the gaussian assumption is rejected at the 5% level, using the Jarque-Bera test. For other asset classes, in Table 4.1, we reported the probability associated with the test statistic. If inferior to 5%, normality is rejected. (4) % of ARPs for which the gaussian assumption is rejected at the 5% level, using the Kolmogorov-Smirnov test. For other asset classes, in Table 4.1, we reported the probability associated with the test statistic. If inferior to 5%, normality is rejected. (5) % of weekly returns that are inferior to the gaussian VaR (weekly, 99%). (6) MSCI World index (bloomberg: NDDUWI). (7) Bloomberg-Barclays Global Bond Aggregate (bloomberg: LEGATRUU). (8) HFRX Global Hedge Fund index (Bloomberg: HFRXGL).

Mean-Variance Properties

ARP universe vs. other asset classes

The average annualized returns, volatilities, and information ratios in different market environments[17] are reported in Exhibit 6. It appears that:

- On average, individual ARPs display similar volatility and annualized returns than bonds. Their average risk-return ratio is higher than those of equities and investable hedge funds[18] (0.51 vs. 0.38 and 0.00 respectively).
- While the risk-return profile of equities deteriorates logically between bullish and bearish periods, that of ARPs remains particularly stable, which is in line with their objective of absolute performance. This is not the case for hedge funds, whose performance deteriorates significantly with market conditions.[19]

For individual ARPs

A more detailed analysis confirms some of the previous results, and also highlights the heterogeneity of the risk-returns profiles within the ARP industry (detailed results in Annex B).

- On average, the return to risk ratio of trading ARPs appears to be more attractive than that of academic ARPs (0.68 vs. 0.38). This difference is mainly due to a higher level of profitability, computed volatility levels being similar.
- Some ARPs show significant sensitivity to a deterioration in market conditions. This is the case for short volatility strategies, which are negatively affected by sudden increases in volatility levels, as illustrated by drop in the average performance of equity short volatility premia from +13.9% in bull markets vs. -12.9 % in down markets. Conversely, momentum, long volatility, and trend strategies show particularly attractive performance levels in bear markets.
- On average, commodity ARPs exhibit the highest information ratios (0.89 on average), followed by interest rate premia (0.74). This outperformance relies on their defensive nature: the highest information ratios are observed for bear market environments, while remaining significant in bull period. Conversely, credit and equity ARPs display the most attractive properties in bull markets (risk-return ratios of 1.18 and 0.96, respectively), but deteriorates significantly during market downturns.
- The review of the risk-return profiles of similar ARPs reveals unexpected level of heterogeneity. For instance, over the same sample period, the equity quality premia display information ratios ranging from 0.06 to 1.34. This perfectly illustrates the impact of the divergences in the implementation processes.

In summary, these results illustrate the ability of ARPs to deliver absolute performance. However, the performance and risk level of certain ARPs appears to be sensitive to the market environment, depending on their nature (academic vs. trading), on the type of premium, or on the underlying asset traded. We also pointed out a significant heterogeneity among the industry, both between and within the various ARP strategies. Selecting and managing ARP allocations thus appears to be less straightforward than expected.

Non-normality of Return Distributions and Extreme Risks

The analysis of higher moments – skewness[20] and kurtosis[21] – is reported in Exhibit 7. It appears that:

- The normality assumption for the return distribution is rejected for 98% of the individual ARPs, mainly because of significant excess kurtosis (7.81 on average), which however remains below the levels measured for equities or hedge funds over the same period (9.2 and 11.9 respectively). This result is not surprising as our analysis period encompasses the 2007-2008 crisis, a period that accounts for the most extreme movements recorded for many asset classes. In Appendix C, we present the results from a partial sample, i.e. with years 2007 and 2008 removed. While we observe a drastic reduction of the excess kurtosis for equities and hedge funds (around 2.2), that of ARPs remains significant (4.52), which underlines that the non-Gaussian nature of their return distributions is more structural.
- As a consequence, extreme losses are more frequent than in the gaussian framework (on average, the 99% VaR was crossed between 1.4 and 2.4 times out of 100 on average, against theoretically 1 time out of 100) and their magnitude is up to 7.9 standard deviations (in the case of equity trading ARPs), corresponding to a theoretical (gaussian) probability of occurrence of 1/10.[15]
- The average kurtosis level of trading ARPs is significantly higher than that of academic ARPs (11.9 vs. 4.6), especially for equity and FX risk premia (25.8 and 12.3 respectively). Intuitively, these figures reflect the binary nature of the risks conveyed by certain strategies, that combine optional derivatives and leverage.
- A more detailed analysis (Appendix D) shows that, for academic ARPs, momentum and value currency premia, as well as rate carry premia, are the most exposed to extreme risks. In terms of trading ARPs, the distributions of the short volatility and mean reversion premiums show particularly heavy distribution tails, accompanied by particularly negative skewness levels for the former.

As in the case of hedge funds and more generally alternative investment strategies, the Gaussian hypothesis is clearly not suited to the analysis of the performances and risks of ARPs (overestimation of performance, underestimation of risks). As previously shown from the mean-variance analysis, our results highlight a strong heterogeneity between academic and trading ARPs on the one hand, and between similar risk premia on the other.

Correlation Analysis

The low level of correlation between the various risk premia strategies, as well as between risk premia and traditional asset classes, is a central argument for ARP investing. They emphasize both the all-weather feature of diversified ARP allocations and the diversification they can bring into a global asset allocation. This strong diversification property comes from the academic foundation of risk premia. Indeed, they are based on the replication of academic factors that have been designed to be (quasi-) orthogonal to market risks, and therefore to carry specific risks. It implicitly follows that the risk premia they generate should be (i) poorly correlated with each other and (ii) exhibit little correlation with market risks (i.e., with the return of the main asset classes). One should therefore expect extremely low correlation levels between ARPs and their underlying market on the one hand, and between the different types of ARPs on the other hand. In contrast, ARPs from different providers aiming to replicate similar risk premia should be significantly correlated, as they are based on the same risk factors.

Correlations between ARPs and other asset classes

The average correlation levels between ARPs, equities, bonds and, hedge funds are reported in Exhibit 8.

- The average correlation levels between ARPs and other asset classes remains generally low, thus justifying their diversification potential in a global portfolio context. This is especially the case for the various academic ARPs (Appendix E1).
- Whatever the underlying asset class, we note the exception of carry premia, that exhibit significant correlations to equities and hedge funds (for FX and credit ARPs), or bonds (rate ARPs). This result is in line with the increased sensitivity of carry strategies to sharp increases in risk aversion, (i.e., during market reversal).
- The correlation levels of trading ARPs with other asset classes also remain contained, except for trading equity premia (average correlation of 0.30 with hedge funds), short volatility and mean reversion premia (significant correlation levels with both equity markets and hedge funds).

All ARPs				
		Asset class		
Underlying	**N**	**Equities**	**Bonds**	**Hedge Funds**
Equities	131	0.06	0.02	0.10
FX	58	0.24	-0.04	0.24
Credit	14	0.17	-0.03	0.19
Rates	49	-0.06	0.21	-0.02
Commodities	41	-0.05	0.02	0.00
Total	**293**	**0.06**	**0.04**	**0.10**
Academic ARPs				
		Asset class		
Underlying	**N**	**Equities**	**Bonds**	**Hedge Funds**
Equities	102	0.00	0.04	0.04
FX	36	0.35	-0.06	0.31
Credit	6	0.29	-0.05	0.28
Rates	13	0.01	0.24	0.03
Commodities	9	-0.06	0.03	0.02
Total	**166**	**0.08**	**0.03**	**0.11**
Trading ARPs				
		Asset class		
Underlying	**N**	**Equities**	**Bonds**	**Hedge Funds**
Equities	29	0.28	-0.04	0.30
FX	22	0.05	0.01	0.13
Credit	8	0.09	-0.01	0.12
Rates	36	-0.09	0.20	-0.04
Commodities	32	-0.05	0.02	-0.01
Total	**127**	**0.04**	**0.05**	**0.08**

Exhibit 8: Average Correlation Levels Between ARPs and Various Asset Classes
Source: Bloomberg, Orion Financial Partners

Correlations Within the ARP Universe

As mentioned earlier, one can expect that the correlation levels between similar ARPs should be significant, and conversely that correlation levels between different ARPs (different factor type or underlying asset class) should be marginal. We reported the average correlation levels between ARPs in Exhibits 9 to 11. It spreads out that:

- As expected, the most significant correlation levels are recorded between similar ARPs (diagonal elements of Exhibits 10 and 11). However, one could have expected more significant levels: they range between -0.05 and 0.80 depending on the ARP strategy, with an average level of 0.40. These relatively low correlation levels can be explained by the differences in the implementation processes of the various providers (factor definition and measurement, selection, allocation, and hedging methodology…), as mentioned previously. Within correlation levels are significantly higher for trading ARPs (0.47 on average vs. 0.30 for academic ARPs).
- The second expectation is also met: the correlation levels between ARPs exploiting different premia and different asset-classes are particularly low (between 0.06 and 0.14), the lowest correlation levels being estimated between academic and trading ARPs (Exhibit 9), whatever the asset class or the premia considered. Correlation levels get reinforced when the nature (trading or academic) and the underlying asset class are the same,[22] diagonal areas in (Exhibits 10 and 9).

It spreads out that the diversification potential in ARP allocations is more important than expected: whereas the argument of cross-premia diversification has been mentioned in the academic literature (and largely taken up by practitioners), the diversification potential between similar ARPs also appears to be significant.

			Academic ARPs															
			Equities								FX			Cred.	Rates		Commodities	
			Carry	Low risk	Mean rev.	Mom	Prof	Qual	Size	Value	Carry	Mom	Value	Carry	Carry	Value	Carry	Mom
Trading ARPs	Equities	M&A Mean reversion	2%	4%	1%	6%	1%	2%	5%	6%	12%	-10%	1%	4%	3%	3%	4%	-2%
		Trend	-5%	14%	12%	3%	-9%	2%	-7%	-2%	21%	-9%	1%	6%	5%	0%	0%	-6%
		Short volatility	2%	-3%	-12%	6%	3%	2%	0%	-5%	4%	25%	-1%	4%	-13%	-5%	7%	15%
		Volatility trading	-3%	8%	8%	2%	-5%	1%	-2%	3%	31%	-13%	-5%	18%	3%	-1%	4%	-7%
			-1%	4%	3%	0%	-2%	1%	-1%	0%	11%	0%	0%	2%	-4%	-1%	1%	2%
	FX	Mean reversion	-4%	11%	16%	5%	2%	7%	-2%	0%	18%	-19%	5%	3%	7%	5%	5%	-7%
		Trend	-1%	0%	-9%	7%	1%	3%	-1%	-5%	-3%	25%	-2%	1%	-5%	-1%	3%	11%
		Short volatility	-2%	12%	4%	4%	-3%	3%	-2%	0%	20%	-11%	-4%	9%	7%	2%	3%	3%
	Credit	Carry	4%	-2%	1%	-2%	-1%	-3%	6%	5%	17%	-8%	-4%	19%	0%	-1%	4%	3%
		Trend	1%	-5%	-15%	-4%	-2%	-4%	-1%	1%	7%	9%	1%	17%	-9%	-6%	-1%	4%
	Rates	Carry Trend	0%	7%	3%	4%	5%	5%	0%	-3%	-3%	2%	-3%	-6%	18%	8%	1%	3%
		Long volatility	0%	12%	0%	5%	4%	7%	-2%	-5%	-9%	6%	-2%	-10%	23%	10%	3%	9%
		Short volatility	-1%	-6%	-7%	2%	7%	2%	0%	-5%	-16%	12%	-1%	-7%	-8%	3%	0%	10%
			-4%	10%	7%	2%	-3%	3%	-3%	1%	19%	-10%	-2%	11%	12%	3%	2%	-5%
	Commodities	Carry	0%	-1%	2%	3%	5%	2%	1%	0%	-2%	9%	-1%	-3%	1%	-1%	29%	20%
		Liquidity	1%	-4%	3%	-3%	3%	-1%	3%	4%	-2%	3%	0%	-1%	1%	-1%	9%	4%
		Momentum	-1%	-3%	4%	0%	3%	0%	0%	2%	-1%	7%	1%	-2%	-1%	0%	24%	13%
		Trend	-6%	4%	-8%	10%	0%	4%	-5%	-8%	-10%	22%	0%	-2%	-1%	-3%	18%	44%
		Short volatility	0%	2%	1%	3%	2%	2%	2%	1%	14%	-2%	-4%	7%	-1%	1%	2%	2%

Exhibit 9: Average Correlation Levels Between Academic ARPs and Trading ARPs
Source: Orion Financial Partners

			Academic ARPs															
			Equities								FX			Credit	Rates		Commodities	
			Carry	Low risk	Mean rev.	Mom	Prof	Qual	Size	Value	Carry	Mom	Value	Carry	Carry	Value	Carry	Mom
Academic ARPs	Equities	Carry Low risk Mean reversion Momentum Profit-ability Quality Size Value	23%	-3%	2%	-4%	13%	-1%	28%	20%	8%	1%	0%	5%	-1%	-3%	0%	-1%
			-3%	43%	3%	9%	5%	21%	-9%	-9%	-4%	0%	2%	-3%	10%	3%	1%	6%
			2%	3%	2%	-1%	0%	1%	4%	2%	5%	-6%	-1%	-4%	5%	5%	2%	-5%
			-4%	9%	-1%	30%	16%	16%	3%	-10%	-1%	10%	-3%	-2%	6%	1%	6%	7%
			13%	5%	0%	16%	38%	24%	20%	0%	-1%	5%	-2%	-2%	-1%	-1%	8%	7%
			-1%	21%	1%	16%	24%	21%	1%	-8%	-3%	4%	0%	-3%	3%	2%	5%	6%
			28%	-9%	4%	3%	20%	1%	33%	21%	5%	-1%	1%	6%	-1%	0%	0%	-3%
			20%	-9%	2%	-10%	0%	-8%	21%	22%	6%	-6%	2%	4%	-1%	-1%	0%	-5%
	FX	Carry Momentum Value	8%	-4%	5%	-1%	-1%	-3%	5%	6%	59%	-9%	-4%	20%	2%	-2%	2%	-5%
			1%	0%	-6%	10%	5%	4%	-1%	-6%	-9%	36%	-5%	-7%	-1%	-5%	8%	14%
			0%	2%	-1%	-3%	-2%	0%	1%	2%	-4%	-5%	17%	-3%	-5%	2%	0%	-1%
	Credit	Carry	5%	-3%	-4%	-2%	-2%	-3%	6%	4%	20%	-7%	-3%	45%	0%	-2%	-3%	-8%
	Rates	Carry Value	-1%	10%	5%	6%	-1%	3%	-1%	-1%	2%	-1%	-5%	0%	39%	7%	2%	2%
			-3%	3%	5%	1%	-1%	2%	0%	-1%	-2%	-5%	2%	-2%	7%	-5%	-1%	1%
	Commodities	Carry Momentum	0%	1%	2%	6%	8%	5%	0%	0%	2%	8%	0%	-3%	2%	-1%	43%	33%
			-1%	6%	-5%	7%	7%	6%	-3%	-5%	-5%	14%	-1%	-8%	2%	1%	33%	35%

Exhibit 10: Average Correlation Levels Between Academic ARPs
Source: Orion Financial Partners

			Trading ARPs																	
			Equities					FX			Credit		Rates				Commodities				
			M&A	Mean rev	Trend	Short vol	Vol trad	Mean rev	Trend	Short vol	Carry	Trend	Carry	Trend	Long vol	Short vol	Carry	Liqu	Mom	Trend	Short vol
Trading ARPs	Equities	M&A Mean reversion Trend Short volatility Volatility trading	56%	21%	-5%	19%	8%	27%	-2%	18%	9%	-7%	-1%	-4%	-16%	16%	1%	0%	4%	-4%	6%
			21%	50%	5%	41%	26%	30%	-2%	17%	7%	2%	-3%	-5%	-19%	17%	-3%	-3%	0%	-1%	7%
			-5%	5%	80%	1%	18%	-23%	30%	-1%	-3%	41%	0%	1%	9%	-6%	5%	0%	2%	32%	2%
			19%	41%	1%	61%	23%	24%	-5%	29%	20%	0%	-7%	-9%	-29%	28%	-5%	-4%	-3%	-10%	18%
			8%	26%	18%	23%	22%	7%	3%	9%	5%	11%	-2%	-4%	-5%	6%	1%	0%	-1%	7%	4%
	FX	Mean reversion Trend Short volatility	27%	30%	-23%	24%	7%	69%	-21%	21%	11%	-16%	3%	-2%	-17%	21%	0%	1%	6%	-16%	8%
			-2%	-2%	30%	-5%	3%	-21%	47%	-2%	-1%	16%	0%	6%	10%	-6%	4%	0%	0%	32%	0%
			18%	17%	-1%	29%	9%	21%	-2%	61%	12%	-1%	0%	-1%	-10%	27%	1%	1%	1%	2%	16%
	Credit	Carry Trend	9%	7%	-3%	20%	5%	11%	-1%	12%	38%	1%	-4%	-7%	-12%	13%	-1%	-1%	1%	-3%	9%
			-7%	2%	41%	0%	11%	-16%	16%	-1%	1%	66%	-2%	-3%	12%	-8%	2%	2%	-1%	21%	1%
	Rates	Carry Trend Long volatility Short volatility	-1%	-3%	0%	-7%	-2%	3%	0%	0%	-4%	-2%	21%	24%	5%	6%	2%	-1%	-2%	3%	0%
			-4%	-5%	1%	-9%	-4%	-2%	6%	-1%	-7%	-3%	24%	42%	8%	-1%	5%	1%	2%	9%	-5%
			-16%	-19%	9%	-29%	-5%	-17%	10%	-10%	-12%	12%	5%	8%	61%	-25%	3%	1%	2%	16%	-8%
			16%	17%	-6%	28%	6%	21%	-6%	27%	13%	-8%	6%	-1%	-25%	49%	-3%	-4%	-2%	-13%	14%
	Commodities	Carry Liquidity Momentum Trend Short volatility	1%	-3%	5%	-5%	1%	0%	4%	1%	-1%	2%	2%	5%	3%	-3%	25%	17%	31%	18%	1%
			0%	-3%	0%	-4%	0%	1%	0%	1%	-1%	2%	-1%	1%	1%	-4%	17%	26%	30%	1%	-3%
			4%	0%	2%	-3%	-1%	6%	0%	1%	1%	-1%	-2%	2%	2%	-2%	31%	30%	25%	10%	-2%
			-4%	-1%	32%	-10%	7%	-16%	32%	2%	-3%	21%	3%	9%	16%	-13%	18%	1%	10%	77%	2%
			6%	7%	2%	18%	4%	8%	0%	16%	9%	1%	0%	-5%	-8%	14%	1%	-3%	-2%	2%	24%

Exhibit 11: Average Correlation Levels Between Trading ARPs
Source: Orion Financial Partners

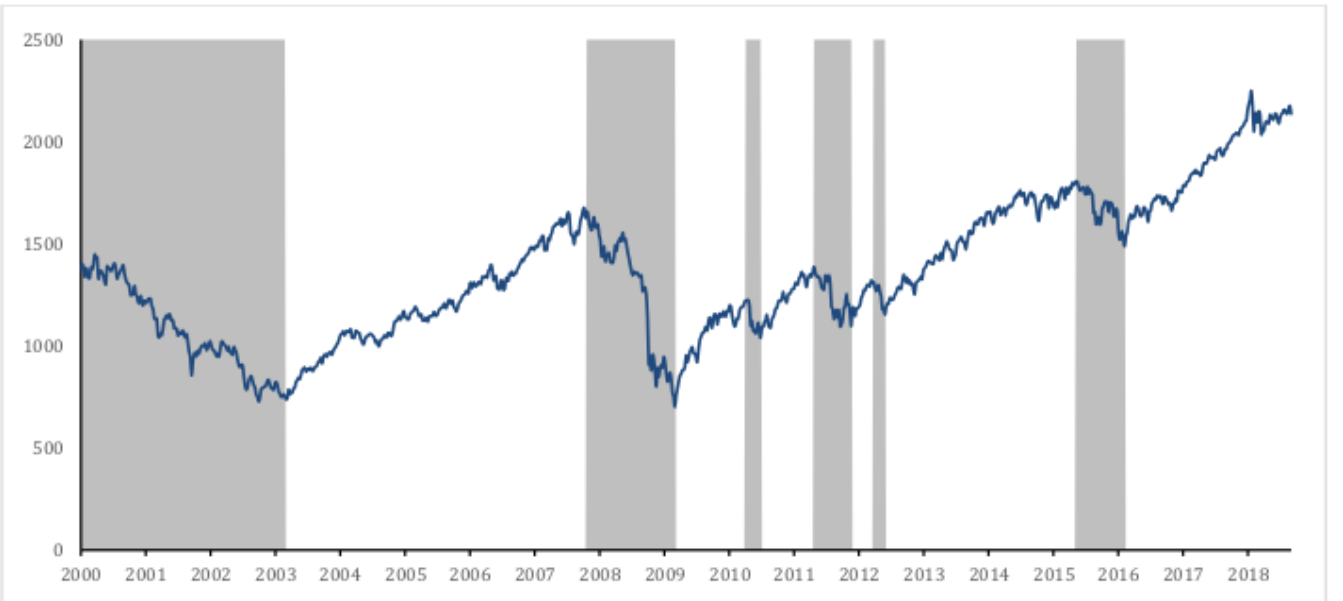
Conclusion

The ARP market can be accessed in three different ways. The first one is to buy ARP indexed products directly from investment banks. The investor then has the complete freedom in the selection process and in the management of his allocation. In return, he must have the necessary skills for selection, portfolio construction, and risk management, both quantitative and qualitative (due diligences). He must also directly manage the swap lines with the various providers.[23] This last point can be blocking for investors whose regulatory constraints or internal investment policy imply a limited use of OTC derivatives, even more when the underlying is not plain vanilla. The second approach consists in investing in ARP funds. In this case, the investor delegates to the manager the selection of the premiums among the investment banks' offering, the construction of the allocation and the risk management. In addition, investing in a fund rather than in swap lines greatly facilitates the operational management of the investment and allows investors subject to a strict regulatory framework to access the ARP market. On the other hand, this delegation generates an additional cost layer at the fund level. The third way is to invest in funds of asset managers that implement their own risk premiums. All investment decisions, from the construction of the premiums themselves to the construction of the allocation and to the risk management are then totally delegated to the manager. If the cost structure is theoretically deflated from the costs inherent to the management of indices and swap lines, investors will generally be charged potentially higher fees at the fund level (management fees and potential performance fees). Furthermore, the diversification level can be severely limited in that case: investing only in the risk premia implemented by the manager induces a high concentration of model risk.

Whatever the investment support considered, investors should keep in mind that ARPs are alternative investment strategies. The implications are particularly important in terms of risk management. Statistical distributions of ARP returns are not Gaussian. They are characterized by negative skewness and a significant kurtosis which, in financial terms, results in a potentially significant exposure to extreme risks. It is therefore appropriate, as in the case of hedge funds, to use appropriate risk management tools.

Beyond these quantitative issues, it is also important to understand the economic origin of these specific risks, especially in the case of trading ARPs. For example, short volatility strategies – whose objective is to capture the structural difference between realized and implied volatility – are particularly exposed to sudden increases in the level of volatility. In the case of currency or credit carry strategies, investors are implicitly exposed to rare but potentially violent risk aversion or liquidity shocks. From an in-depth qualitative analysis, one can anticipate a potential correlation jump between short volatility and carry risk premia during extreme markets events, even if they exploit different premia and focus on different asset classes! Therefore, we see the interest of completing quantitative analysis by qualitative analysis through due diligences in a sound risk management process. Qualitative analysis is even more important as the available historical data provided by investment banks are partly derived from backtests, and therefore convey potentially significant bias.[24]

Appendix



Appendix A: Definition of bull and bear periods

Source: Bloomberg, Orion Financial Partners

We have defined as bear market conditions periods for which the MSCI World Index (bloomberg: NDDUWI) recorded drawdowns of at least 10% (shaded in grey on the chart below). This are the periods January 2000 – February 2002; October 2007 – March 2009; April 2010 – July 2010; April 2011 – November 2011; March 2012 – June 2012; May 2015 – February 2016. Remaining periods are considered as bull periods.

B1– Academic ARPs											
Underlying asset	**Risk premia**	**N**	**μ**	**σ**	**IR**	**μ+**	**σ+**	**IR+**	**μ-**	**σ-**	**IR-**
Equities	Carry	6	1.4%	6.6%	0.26	2.6%	5.4%	0.49	-1.8%	8.8%	-0.14
	Growth	1	2.1%	5.4%	0.39	-1.9%	4.7%	-0.39	12.7%	6.6%	1.93
	Liquidity	1	1.8%	4.6%	0.39	1.9%	4.0%	0.48	1.4%	5.9%	0.24
	Low risk	20	3.1%	5.9%	0.53	1.7%	5.2%	0.30	6.8%	7.2%	1.03
	Mean reversion	2	2.4%	3.7%	0.67	2.0%	3.3%	0.66	3.7%	4.5%	0.80
	Momentum	20	2.4%	7.3%	0.31	1.7%	6.5%	0.23	4.3%	8.9%	0.50
	Profitability	5	3.6%	5.2%	0.66	2.4%	4.4%	0.51	6.9%	6.9%	0.97
	Quality	16	3.4%	5.0%	0.66	2.1%	4.5%	0.39	6.9%	5.8%	1.23
	Size	9	1.8%	6.9%	0.29	2.9%	5.9%	0.50	-1.0%	9.0%	0.00
	Value	22	1.0%	6.2%	0.16	2.3%	5.4%	0.41	-2.5%	7.7%	-0.30
	Total	**102**	**2.3%**	**6.1%**	**0.39**	**2.1%**	**5.4%**	**0.36**	**3.1%**	**7.6%**	**0.50**
FX	Carry	27	0.8%	8.4%	0.10	5.4%	7.3%	0.73	-11.5%	10.5%	-1.10
	Momentum	2	3.9%	10.5%	0.38	1.9%	8.6%	0.17	9.2%	14.2%	0.67
	Value	7	2.7%	6.3%	0.44	1.8%	5.7%	0.32	5.2%	7.5%	0.68
	Total	**36**	**1.4%**	**8.1%**	**0.19**	**4.5%**	**7.1%**	**0.62**	**-7.1%**	**10.1%**	**-0.65**
Credit	Carry	6	2.4%	3.5%	0.68	3.8%	3.0%	1.33	-1.4%	4.7%	-0.32
	Total	**6**	**2.4%**	**3.5%**	**0.68**	**3.8%**	**3.0%**	**1.33**	**-1.4%**	**4.7%**	**-0.32**
Rates	Carry	9	1.6%	3.7%	0.42	1.4%	3.1%	0.49	2.0%	4.9%	0.42
	Momentum	1	2.4%	4.7%	0.51	1.5%	4.1%	0.35	5.0%	5.9%	0.84
	Value	3	1.2%	3.6%	0.38	1.1%	3.1%	0.35	1.5%	4.5%	0.42
	Total	**13**	**1.6%**	**3.8%**	**0.42**	**1.4%**	**3.2%**	**0.45**	**2.1%**	**4.9%**	**0.45**
Commo.	Carry	6	6.3%	7.8%	0.83	4.3%	7.5%	0.61	11.8%	8.5%	1.39
	Momentum	2	3.4%	12.1%	0.29	-0.1%	10.8%	-0.05	12.9%	14.8%	0.87
	Value	1	9.1%	9.9%	0.93	5.4%	9.3%	0.58	19.2%	11.1%	1.72
	Total	**9**	**6.0%**	**9.0%**	**0.72**	**3.4%**	**8.4%**	**0.46**	**12.9%**	**10.2%**	**1.31**
Academic ARPs		**166**	**2.3%**	**6.4%**	**0.38**	**2.7%**	**5.7%**	**0.47**	**1.2%**	**8.0%**	**0.26**

Appendix B: Risk-return profile of ARPs: detailed results

Source: Bloomberg, Orion Financial Partners

Average annualized return, σ: volatility, IR: information ratio (μ/σ). Suffixes + and – denote bullish and down periods of the MSCI world index, as defined in Appendix A. Reported statistics are computed over the period 01/05/2007 – 09/07/2018, from weekly data. They are the averages of statistics computed for individual ARPs.

B2– Trading ARPs											
Underlying asset	Risk premia	N	μ	σ	IR	μ+	σ+	IR+	μ-	σ-	IR-
Equities	M&A	4	2.7%	5.1%	0.54	3.3%	4.0%	0.85	1.2%	7.2%	0.22
	Mean reversion	5	6.0%	9.2%	0.62	6.4%	5.8%	1.19	5.1%	14.7%	0.30
	Trend	5	0.8%	7.3%	0.13	0.9%	6.8%	0.18	0.3%	8.6%	0.03
	Short volatility	7	6.6%	12.3%	0.52	13.9%	8.7%	1.48	-12.9%	18.3%	-0.54
	Volatility trading	8	7.5%	10.9%	0.76	8.4%	9.3%	0.91	5.4%	14.1%	0.46
	Total	29	5.2%	9.5%	0.54	7.4%	7.4%	0.96	-0.5%	13.3%	0.08
FX	Liquidity	1	9.2%	7.7%	1.19	7.5%	6.9%	1.09	13.6%	9.5%	1.43
	Mean reversion	4	5.1%	9.9%	0.45	2.6%	7.0%	0.38	12.0%	15.2%	0.65
	Trend Value	11 1	2.7% 3.1%	7.3% 5.1%	0.46 0.61	2.1% 2.1%	6.7% 4.3%	0.41 0.49	4.2% 5.8%	8.8% 6.8%	0.56 0.86
	Short volatility	5	0.7%	2.8%	0.20	0.5%	2.3%	0.18	1.2%	3.9%	0.26
	Total	22	3.0%	6.7%	0.44	2.1%	5.6%	0.39	5.5%	8.8%	0.56
Credit	Carry Trend	2 6	2.8% 4.9%	4.5% 7.1%	0.62 0.68	5.9% 6.3%	3.5% 6.2%	1.70 1.01	-5.5% 1.1%	6.4% 9.0%	-0.86 0.10
	Total	8	4.4%	6.4%	0.66	6.2%	5.5%	1.18	-0.5%	8.4%	-0.14
Rates	Carry	11	1.5%	2.2%	0.71	0.9%	2.0%	0.54	2.9%	2.6%	1.09
	Momentum	1	1.2%	2.0%	0.61	-0.2%	1.6%	-0.10	4.9%	2.7%	1.84
	Trend	13	3.1%	4.5%	0.83	1.0%	4.1%	0.40	8.7%	5.3%	1.80
	Long volatility	4	3.7%	5.8%	0.63	0.9%	4.4%	0.20	11.2%	8.5%	1.32
	Short volatility	6	6.4%	8.4%	0.72	9.3%	6.1%	1.43	-1.3%	12.5%	-0.19
	Volatility carry	1	0.5%	1.3%	0.41	0.9%	1.0%	0.90	-0.5%	1.8%	-0.31
	Total	36	3.1%	4.4%	0.74	2.3%	3.7%	0.59	5.2%	5.9%	1.14
Commo.	Carry	10	5.1%	6.4%	0.93	3.6%	5.8%	0.69	9.0%	7.6%	1.43
	Liquidity	8	2.9%	3.0%	1.18	1.8%	2.9%	0.92	5.7%	3.3%	1.80
	Momentum	2	5.0%	4.5%	1.26	3.6%	4.2%	1.09	8.7%	5.3%	1.66
	Trend	6	6.0%	10.5%	0.53	2.1%	7.7%	0.24	16.4%	15.6%	1.00
	Value	1	3.5%	4.3%	0.82	2.7%	4.2%	0.64	5.8%	4.6%	1.25
	Short volatility	5	7.6%	11.1%	0.68	11.8%	9.9%	1.22	-3.7%	13.4%	-0.22
	Total	32	5.0%	6.9%	0.89	4.1%	5.9%	0.77	7.4%	8.7%	1.19
ARP de trading		127	4.1%	6.7%	0.68	4.1%	5.5%	0.72	4.1%	8.9%	0.73

Appendix B: Risk-return profile of ARPs: detailed results

Source: Bloomberg, Orion Financial Partners

Average annualized return, σ: volatility, IR: information ratio (μ/σ). Suffixes + and – denote bullish and down periods of the MSCI world index, as defined in Appendix A. Reported statistics are computed over the period 01/05/2007 – 09/07/2018, from weekly data. They are the averages of statistics computed for individual ARPs.

C.1 – ARP and other asset classes							
Underlying	N	Skewness (1)	Excess kurtosis (2)	% of non- gaussian distributions JB-stat (3)	% of non- gaussian distributions KSL-stat (4)	Worst negative choc (in standard deviations)	% of VaR(99%) crossing (5)
ARP	**293**	**-0.18**	**4.52**	**97%**	**81%**	**4.81**	**1.7%**
Equities (6)	-	-0.36	2.27	Prob<1%	Prob<1%	4.09	2.2%
Bonds (7)	-	-0.12	1.03	Prob<1%	Prob>5%	3.70	1.6%
Hedge Funds (8)	-	-0.88	2.22	Prob<1%	Prob<1%	4.92	2.8%
C.2 – Academic ARPs							
Underlying asset	N	Skewness (1)	Excess kurtosis (2)	% of non- gaussian distributions JB-stat (3)	% of non- gaussian distributions KSL-stat (4)	Worst negative choc (in standard deviations)	% of VaR(99%) crossing (5)
Equities	102	-0.01	2.06	94%	71%	4.18	1.5%
FX	36	-0.40	4.38	97%	89%	5.12	1.7%
Credit	6	-0.23	3.42	100%	100%	4.74	2.1%
Rates	13	-0.03	2.99	100%	69%	4.37	1.5%
Commodities	9	-0.09	1.45	89%	22%	4.10	1.5%
Total	**166**	**-0.11**	**2.65**	**95%**	**73%**	**4.42**	**1.6%**
C.3 - Trading ARPs							
Underlying asset	N	Skewness (1)	Excess kurtosis (2)	% of non- gaussian distributions JB-stat (3)	% of non- gaussian distributions KSL-stat (4)	Worst negative choc (in standard deviations)	% of VaR(99%) crossing (5)
Equities	29	-0.96	11.99	100%	100%	6.34	2.1%
FX	22	-0.13	7.58	100%	82%	5.37	1.7%
Credit	8	-0.15	4.44	100%	100%	5.31	1.7%
Rates	36	-0.17	4.11	100%	94%	4.89	1.8%
Commodities	32	0.09	5.84	97%	81%	4.90	1.8%
Total	**127**	**-0.28**	**6.97**	**99%**	**91%**	**5.33**	**1.8%**

Appendix C: Higher moments, normality tests and extreme risks (2009-2018)

Source: Bloomberg, Orion Financial Partners

Reported results are the averages of the statistics computed for individual ARPs, over the period 01/01/2009 – 09/07/2018, from weekly data. (1) Asymmetry coefficient. When negative, occurrence probability of extreme losses is higher than for extreme gains. (2) When excess kurtosis is significantly positive, the probability of extreme events is higher than, in the gaussian case. (3) % of ARPs for which the gaussian assumption is rejected at the 5% level, using the Jarque-Bera test. For other asset classes, in Table C.1, we reported the probability associated with the test statistic. If inferior to 5%, normality is rejected. (4) % of ARPs for which the gaussian assumption is rejected at the 5% level, using the Kolmogorov-Smirnov test. For other asset classes, in Table C.1, we reported the probability associated with the test statistic. If inferior to 5%, normality is rejected. (5) % of weekly returns that are inferior to the gaussian VaR (weekly, 99%). (6) MSCI World index (Bloomberg: NDDUWI). (7) Bloomberg-Barclays Global Bond Aggregate (Bloomberg: LEGATRUU). (8) HFRX Global Hedge Fund index (Bloomberg: HFRXGL).

D1 – Academic ARP								
Underlying asset	Risk premia	N	Skewness (1)	Excess kurtosis (2)	% of non- gaussian distributio ns JB-stat (3)	% of non- gaussian distributio ns KSL-stat (4)	Worst negative choc (in standard deviations)	% of VaR(99%) crossing (5)
Equities	Carry	6	0.32	4.51	67%	67%	4.31	1.4%
	Growth	1	-0.18	1.46	100%	100%	3.50	1.8%
	Liquidity	1	0.08	1.01	100%	0%	3.84	1.0%
	Low risk	20	-0.54	6.08	100%	100%	6.19	1.6%
	Mean reversion	2	0.72	7.45	100%	100%	4.48	1.6%
	Momentum	20	-0.39	2.29	100%	80%	4.74	1.8%
	Profitability	5	0.05	3.93	100%	60%	5.11	1.2%
	Quality	16	-0.07	2.09	94%	75%	4.33	1.5%
	Size	9	0.29	4.90	100%	100%	4.95	1.5%
	Value	22	0.33	3.88	100%	95%	4.49	1.3%
	Total	**102**	**-0.06**	**3.87**	**97%**	**86%**	**4.89**	**1.5%**
FX	Carry	27	-0.63	4.32	100%	100%	5.64	2.0%
	Momentum	2	1.32	13.44	100%	100%	4.26	1.2%
	Value	7	-0.26	12.51	100%	71%	6.63	1.0%
	Total	**36**	**-0.45**	**6.42**	**100%**	**94%**	**5.76**	**1.8%**
Credit	Carry	6	-0.50	5.78	100%	100%	5.68	2.4%
	Total	**6**	**-0.50**	**5.78**	**100%**	**100%**	**5.68**	**2.4%**
Rates	Carry	9	-0.30	10.08	100%	67%	6.08	1.4%
	Momentum	1	-0.37	3.12	100%	100%	5.19	1.3%
	Value	3	-0.01	2.37	100%	67%	4.00	1.6%
	Total	**13**	**-0.24**	**7.77**	**100%**	**69%**	**5.53**	**1.5%**
Commo.	Carry	6	0.03	0.96	100%	33%	3.71	1.4%
	Momentum	2	0.11	3.32	100%	100%	4.67	1.5%
	Value	1	-0.06	1.25	100%	0%	4.37	1.1%
	Total	**9**	**0.04**	**1.51**	**100%**	**44%**	**4.00**	**1.4%**
ARP académiques		**166**	**-0.17**	**4.67**	**98%**	**85%**	**5.11**	**1.6%**

Appendix D: Higher moments, normality tests and extreme risks: detailed results

Source: Bloomberg, Orion Financial Partners

Reported results are the averages of the statistics computed for individual ARPs, over the period 01/05/2007 – 09/07/2018, from weekly data. (1) Asymmetry coefficient. When negative, occurrence probability of extreme losses is higher than for extreme gains. (2) When excess kurtosis is significantly positive, the probability of extreme events is higher than, in the gaussian case. (3) % of ARPs for which the gaussian assumption is rejected at the 5% level, using the Jarque-Bera test. For other asset classes, in Table D.1, we reported the probability associated with the test statistic. If inferior to 5%, normality is rejected. (4) % of ARPs for which the gaussian assumption is rejected at the 5% level, using the Kolmogorov-Smirnov test. For other asset classes, in Table D.1, we reported the probability associated with the test statistic. If inferior to 5%, normality is rejected. (5) % of weekly returns that are inferior to the gaussian VaR (weekly, 99%). (6) MSCI World index (Bloomberg: NDDUWI). (7) Bloomberg-Barclays Global Bond Aggregate (Bloomberg: LEGATRUU). (8) HFRX Global Hedge Fund index (Bloomberg: HFRXGL).

D2 – Trading ARPs								
Underlying asset	Risk premia	N	Skewness (1)	Excess kurtosis (2)	% of non- gaussian distributio ns JB-stat (3)	% of non- gaussian distributio ns KSL-stat (4)	Worst negative choc (in standard deviations)	% of VaR(99%) crossing (5)
Equities	M&A	4	-0.01	17.33	100%	100%	6.99	1.4%
	Mean reversion	5	0.10	32.65	100%	100%	8.61	1.7%
	Trend	5	0.65	14.71	100%	100%	5.29	1.8%
	Short volatility	7	-4.08	41.29	100%	100%	11.21	2.2%
	Volatility trading	8	-0.01	19.13	100%	100%	6.80	2.1%
	Total	**29**	**-0.86**	**25.80**	**100%**	**100%**	**7.94**	**1.9%**
FX	Liquidity	1	2.74	20.91	100%	100%	5.45	1.0%
	Mean reversion	4	0.36	31.45	100%	100%	8.26	1.0%
	Trend Value	11	0.26	4.43	100%	91%	4.74	1.3%
		1	1.26	15.72	100%	100%	5.39	1.6%
	Short volatility	5	-1.47	12.29	100%	100%	7.88	2.4%
	Total	**22**	**0.04**	**12.39**	**100%**	**95%**	**6.15**	**1.5%**
Credit	Carry	2	-0.79	6.68	100%	100%	5.78	3.0%
	Trend	6	0.45	5.30	100%	100%	4.90	1.4%
	Total	**8**	**0.14**	**5.65**	**100%**	**100%**	**5.12**	**1.8%**
Rates	Carry	11	-0.17	4.43	100%	100%	5.39	1.7%
	Momentum	1	0.65	5.21	100%	100%	4.53	1.1%
	Trend	13	-0.07	2.76	100%	100%	4.66	1.7%
	Long volatility	4	1.37	14.97	100%	100%	4.95	1.0%
	Short volatility	6	-0.89	18.09	100%	100%	7.84	2.1%
	Volatility carry	1	-0.77	6.79	100%	100%	5.60	2.6%
	Total	**36**	**-0.07**	**7.36**	**100%**	**100%**	**5.47**	**1.7%**
Commo.	Carry	10	0.18	2.75	90%	80%	4.44	1.4%
	Liquidity	8	1.16	8.47	88%	75%	4.29	1.3%
	Momentum	2	0.50	2.54	100%	100%	3.64	1.6%
	Trend	6	0.50	9.26	100%	100%	5.57	1.7%
	Value	1	-0.17	0.92	100%	100%	4.07	1.8%
	Short volatility	5	-0.95	5.25	100%	100%	5.47	2.5%
	Total	**32**	**0.32**	**5.72**	**94%**	**88%**	**4.71**	**1.6%**
ARP de trading		**127**	**-0.12**	**11.92**	**98%**	**96%**	**5.94**	**1.7%**

Appendix D: Higher moments, normality tests and extreme risks: detailed results

Source: Bloomberg, Orion Financial Partners

Reported results are the averages of the statistics computed for individual ARPs, over the period 01/05/2007 – 09/07/2018, from weekly data. (1) Asymmetry coefficient. When negative, occurrence probability of extreme losses is higher than for extreme gains. (2) When excess kurtosis is significantly positive, the probability of extreme events is higher than, in the gaussian case. (3) % of ARPs for which the gaussian assumption is rejected at the 5% level, using the Jarque-Bera test. For other asset classes, in Table D.1, we reported the probability associated with the test statistic. If inferior to 5%, normality is rejected. (4) % of ARPs for which the gaussian assumption is rejected at the 5% level, using the Kolmogorov-Smirnov test. For other asset classes, in Table D.1, we reported the probability associated with the test statistic. If inferior to 5%, normality is rejected. (5) % of weekly returns that are inferior to the gaussian VaR (weekly, 99%). (6) MSCI World index (Bloomberg: NDDUWI). (7) Bloomberg-Barclays Global Bond Aggregate (Bloomberg: LEGATRUU). (8) HFRX Global Hedge Fund index (Bloomberg: HFRXGL).

E.1 – Academic ARPs					
Underlying assets	**Risk premia**	**N**	**Equities**	**Bonds**	**Hedge Funds**
Equities	Carry	6	0.08	0.10	0.04
	Growth	1	-0.61	0.10	-0.36
	Liquidity	1	0.05	0.09	0.13
	Low risk	20	-0.06	0.06	-0.02
	Mean reversion	2	0.12	0.09	-0.01
	Momentum	20	-0.04	0.04	0.11
	Profitability	5	-0.07	0.05	-0.02
	Quality	16	-0.08	0.00	-0.01
	Size	9	0.08	0.06	0.09
	Value	22	0.12	0.02	0.08
	Total	**102**	**0.00**	**0.04**	**0.04**
FX	Carry	27	0.50	-0.03	0.44
	Momentum Value	2 7	-0.19 -0.08	0.04 -0.22	-0.05 -0.09
	Total	**36**	**0.35**	**-0.06**	**0.31**
Credit	Carry	6	0.29	-0.05	0.28
	Total	**6**	**0.29**	**-0.05**	**0.28**
Rates	Carry	9	0.02	0.30	0.04
	Momentum Value	1 3	-0.05 -0.01	0.26 0.05	0.06 0.01
	Total	**13**	**0.01**	**0.24**	**0.03**
Commo.	Carry	6	-0.01	0.03	0.04
	Momentum Value	2 1	-0.16 -0.09	0.03 0.10	-0.06 0.00
	Total	**9**	**-0.06**	**0.03**	**0.02**
Academic ARPs		**166**	**0.08**	**0.03**	**0.11**

Appendix E: Correlation between ARPs and other asset classes: detailed results
Source: Bloomberg, Orion Financial Partners

E.2 – Trading ARPs					
Underlying asset	**Risk premia**	**N**	**Equities**	**Bonds**	**Hedge Funds**
Equities	M&A	4	0.23	-0.06	0.30
	Mean reversion	5	0.41	-0.04	0.32
	Trend Short volatility	5 7	-0.04 0.56	-0.10 0.02	0.17 0.54
	Volatility trading	8	0.18	-0.05	0.15
	Total	**29**	**0.28**	**-0.04**	**0.30**
FX	Liquidity	1	0.00	0.06	-0.07
	Mean reversion	4	0.31	0.01	0.22
	Trend Value	11 1	-0.12 -0.03	-0.01 -0.01	0.06 -0.07
	Short volatility	5	0.23	0.03	0.28
	Total	**22**	**0.05**	**0.01**	**0.13**
Credit	Carry	2	0.27	0.04	0.28
	Trend	6	0.03	-0.03	0.06
	Total	**8**	**0.09**	**-0.01**	**0.12**
Rates	Carry	11	-0.09	0.23	-0.07
	Momentum	1	-0.30	0.16	-0.16
	Trend	13	-0.20	0.30	-0.10
	Long volatility	4	-0.31	0.02	-0.26
	Short volatility	6	0.27	0.06	0.29
	Volatility carry	1	0.26	0.02	0.17
	Total	**36**	**-0.09**	**0.20**	**-0.04**
Commo.	Carry	10	-0.09	0.01	-0.05
	Liquidity	8	-0.02	0.01	-0.05
	Momentum	2	-0.05	-0.04	-0.04
	Trend	6	-0.23	0.03	-0.03
	Value	1	-0.03	0.04	-0.09
	Short volatility	5	0.18	0.05	0.21
	Total	**32**	**-0.05**	**0.02**	**-0.01**
Trading ARPs		**127**	**0.04**	**0.05**	**0.08**

Appendix E: Correlation between ARPs and other asset classes: detailed results
Source: Bloomberg, Orion Financial Partners

			Academic ARP															
			Equities								FX			Cred.	Rates		Commodities	
			Carry	Low Risk	Mean Rev.	Mom	Prof	Qual	Size	Value	Carry	Mom	Value	Carry	Carry	Value	Carry	Mom
Academic ARP	Equities	Carry Low risk Mean reversion Momentum Profitability Quality Size Value	23%	-3%	2%	-4%	13 %	-1%	28 %	20%	8%	1%	0%	5%	-1%	-3%	0%	-1%
			-3%	43%	3%	9 %	5%	21%	-9%	-9%	-4 %	0%	2%	-3%	10 %	3%	1%	6%
			2%	3%	2%	-1%	0%	1%	4%	2%	5%	-6 %	-1%	-4%	5%	5%	2%	-5%
			-4%	9%	-1%	30%	16%	16%	3%	-10 %	-1%	10 %	-3%	-2%	6%	1%	6%	7%
			13 %	5%	0%	16%	38%	24%	20%	0%	-1%	5%	-2%	-2%	-1%	-1%	8%	7%
			-1%	21%	1%	16%	24%	21%	1%	-8 %	-3%	4%	0%	-3%	3%	2	5%	6%
			28%	-9%	4%	3%	20%	1%	33%	21%	5%	-1%	1%	6%	-1%	0	0%	-3%
			20%	-9%	2%	-10 %	0%	-8 %	21%	22%	6%	-6 %	2%	4%	-1%	-1%	0%	-5%
	FX	Carry Momentum Value	8%	-4 %	5%	-1%	-1%	-3 %	5%	6%	59 %	-9 %	-4%	20%	2%	-2%	2%	-5%
			1%	0%	-6 %	10 %	5%	4%	-1%	-6 %	-9 %	36%	-5%	-7%	-1%	-5%	8%	14 %
			0%	2%	-1%	-3%	-2%	0%	1%	2%	-4%	-5%	17%	-3 %	-5%	2%	0%	-1%
	Crzdit	Carry	5%	-3%	-4%	-2%	-2%	-3 %	6%	4%	20%	-7%	-3 %	45%	0%	-2%	-3 %	-8 %
	Rates	Carry Value	-1%	10 %	5%	6%	-1%	3%	-1%	-1%	2%	-1%	-5%	0%	39%	7%	2%	2%
			-3%	3%	5%	1%	-1%	2%	0%	-1%	-2%	-5%	2%	-2%	7%	-5%	-1%	1%
	Commo.	Carry Momentum	0%	1%	2%	6%	8%	5%	0%	0%	2%	8%	0%	-3 %	2%	-1%	43%	33%
			-1%	6%	-5%	7%	7%	6%	-3%	-5%	-5%	14 %	-1%	-8 %	2%	1%	33%	35%
Trading ARP	Equities	M&A Mean reversion Trend Short volatility Volatility trading	2%	4%	1%	6%	1%	2%	5%	6%	12 %	-10%	1%	4%	3%	3%	4%	-2%
			-5%	14%	12%	3%	-9 %	2%	-7%	-2%	21%	-9%	1%	6%	5%	0%	0%	-6 %
			2%	-3%	-12 %	6%	3%	2%	0%	-5%	4%	25%	-1%	4%	-13 %	-5%	7%	15%
			-3%	8%	8%	2%	-5%	1%	-2%	3%	31%	-13 %	-5%	18 %	3%	-1%	4%	-7%
			-1%	4%	3%	0%	-2 %	1%	-1%	0%	11%	0%	0%	2%	-4 %	-1%	1%	2%
	FX	Mean reversion Trend Short volatility	-4 %	11%	16 %	5%	2%	7%	-2%	0%	18 %	-19 %	5%	3%	7%	5%	5%	-7%
			-1%	0%	-9 %	7%	1%	3%	-1%	-5%	-3 %	25%	-2 %	1%	-5%	-1%	3%	11%
			-2 %	12 %	4%	4%	-3%	3%	-2%	0%	20%	-11%	-4 %	9%	7%	2%	3%	3%
	Credit	Carry Trend	4%	-2%	1%	-2%	-1%	-3 %	6%	5%	17%	-8 %	-4 %	19%	0%	-1%	4%	3%
			1%	-5%	-15%	-4%	-2%	-4%	-1%	1%	7%	9%	1%	17%	-9%	-6%	-1%	4%
	Rates	Carry Trend Long volatility Short volatility	0%	7%	3%	4%	5%	5%	0%	-3%	-3 %	2%	-3 %	-6 %	18 %	8%	1%	3%
			0%	12 %	0%	5%	4%	7%	-2%	-5%	-9 %	6%	-2%	-10%	23%	10%	3%	9%
			-1%	-6%	-7%	2%	7%	2%	0%	-5%	-16 %	12 %	-1%	-7%	-8 %	3%	0%	10%
			-4%	10%	7%	2%	-3 %	3%	-3%	1%	19 %	-10 %	-2%	11%	12 %	3%	2%	-5%
	Commo.	Carry Liquidity Momentum Trend Short volatility	0%	-1%	2%	3%	5%	2%	1%	0%	-2%	9%	-1%	-3%	1%	-1%	29%	20%
			1%	-4%	3%	-3%	3%	-1%	3%	4%	-2%	3%	0%	-1%	1%	-1%	9%	4%
			-1%	-3%	4%	0%	3%	0%	0%	2%	-1%	7%	1%	-2%	-1%	0%	24%	13 %
			-6 %	4%	-8 %	10 %	0%	4%	-5%	-8%	-10 %	22%	0%	-2%	-1%	-3%	18 %	44%
			0%	2%	1%	3%	2%	2%	2%	1%	14 %	-2 %	-4%	7%	-1%	1%	2%	2%

Appendix F: Average correlation levels between ARPs
Source: Orion Financial Partners

Trading ARP																			
Equities						FX			Credit		Rates				Commodities				
M&A	Mean Rev	Trend	Short Vol.	Vol. Trade	Mean Rev	Trend	Short Vol	Carry	Trend	Carry	Trend	Long Vol	Short Vol	Carry	Liqu	Mom	Trend	Short Vol
2%	-5%	2%	-3%	-1%	-4%	-1%	-2%	4%	1%	0%	0%	-1%	-4%	0%	1%	-1%	-6 %	0%
4%	14%	-3 %	8%	4%	11%	0%	12 %	-2%	-5%	7%	12 %	-6%	10%	-1%	-4%	-3%	4%	2%
1%	12%	-12 %	8%	3%	16 %	-9 %	4%	1%	-15%	3%	0%	-7%	7%	2%	3%	4%	-8 %	1%
6%	3%	6%	2%	0%	5%	7%	4%	-2%	-4%	4%	5%	2%	2%	3%	-3%	0%	10 %	3%
1%	-9 %	3%	-5%	-2 %	2%	1%	-3%	-1%	-2%	5%	4%	7%	-3%	5%	3%	3%	0%	2%
2%	2%	2%	1%	1%	7%	3%	3%	-3 %	-4%	5%	7%	2%	3%	2%	-1%	0%	4%	2%
5%	-7%	0%	-2%	-1%	-2%	-1%	-2%	6%	-1%	0%	-2%	0%	-3%	1%	3%	0%	-5%	2%
6%	-2%	-5%	3%	0%	0%	-5%	0%	5%	1%	-3%	-5%	-5%	1%	0%	4%	2%	-8%	1%
12 %	21%	4%	31%	11%	18 %	-3 %	20%	17%	7%	-3 %	-9 %	-16 %	19 %	-2%	-2%	-1%	-10 %	14 %
-10%	-9%	25%	-13 %	0%	-19 %	25%	-11%	-8 %	9%	2%	6%	12 %	-10 %	9%	3%	7%	22%	-2%
1%	1%	-1%	-5%	0%	5%	-2%	-4%	-4 %	1%	-3%	-2%	-1%	-2%	-1%	0%	1%	0%	-4%
4%	6%	4%	18 %	2%	3%	1%	9%	19%	17%	-6%	-10%	-7%	11%	-3%	-1%	-2%	-2%	7%
3%	5%	-13 %	3%	-4 %	7%	-5%	7%	0%	-9%	18%	23%	-8%	12 %	1%	1%	-1%	-1%	-1%
3%	0%	-5%	-1%	-1%	5%	-1%	2%	-1%	-6%	8%	10%	3%	3%	-1%	-1%	0%	-3%	1%
4%	0%	7%	4%	1%	5%	3%	3%	4%	-1%	1%	3%	0%	2%	29%	9%	24%	18 %	2%
-2%	-6 %	15%	-7%	2%	-7%	11%	3%	3%	4%	3%	9%	10%	-5%	20%	4%	13 %	44%	2%
56 %	21%	-5%	19 %	8%	27%	-2%	18%	9%	-7%	-1%	-4%	-16%	16%	1%	0%	4%	-4%	6%
21%	50 %	5%	41%	26%	30%	-2%	17%	7%	2%	-3%	-5%	-19%	17%	-3%	-3%	0%	-1%	7%
-5%	5%	80%	1%	18 %	-23 %	30%	-1%	-3 %	41%	0%	1%	9%	-6 %	5%	0%	2%	32%	2%
19 %	41%	1%	61%	23%	24%	-5%	29%	20%	0%	-7%	-9%	-29 %	28%	-5%	-4%	-3%	-10 %	18 %
8%	26%	18 %	23%	22%	7%	3%	9%	5%	11%	-2%	-4%	-5%	6%	1%	0%	-1%	7%	4%
27%	30%	-23 %	24%	7%	69%	-21%	21%	11%	-16 %	3%	-2%	-17%	21%	0%	1%	6 %	-16 %	8%
-2%	-2%	30%	-5%	3%	-21%	47%	-2 %	-1%	16 %	0%	6%	10 %	-6 %	4%	0%	0%	32%	0%
18%	17%	-1%	29%	9%	21%	-2 %	61%	12 %	-1%	0%	-1%	-10 %	27%	1%	1%	1%	2%	16 %
9%	7%	-3 %	20%	5%	11%	-1%	12 %	38%	1%	-4%	-7%	-12 %	13 %	-1%	-1%	1%	-3%	9%
-7%	2 %	41%	0%	11%	-16 %	16 %	-1%	1%	66%	-2%	-3%	12 %	-8 %	2%	2%	-1%	21%	1%
-1%	-3%	0%	-7%	-2 %	3%	0%	0%	-4%	-2%	21%	24%	5%	6%	2%	-1%	-2%	3%	0%
-4%	-5%	1%	-9%	-4 %	-2 %	6%	-1%	-7%	-3 %	24%	42%	8%	-1%	5%	1%	2%	9%	-5%
-16%	-19%	9%	-29 %	-5%	-17%	10 %	-10 %	-12 %	12 %	5%	8%	61%	-25%	3%	1%	2%	16 %	-8%
16%	17%	-6 %	28%	6%	21%	-6 %	27%	13 %	-8 %	6%	-1%	-25%	49%	-3%	-4%	-2%	-13 %	14 %
1%	-3%	5%	-5%	1%	0%	4%	1%	-1%	2%	2%	5%	3%	-3%	25%	17%	31%	18 %	1%
0%	-3%	0%	-4%	0%	1%	0%	1%	-1%	2%	-1%	1%	1%	-4%	17%	26%	30%	1%	-3%
4%	0%	2%	-3%	-1%	6%	0%	1%	1%	-1%	-2%	2%	2%	-2%	31%	30%	25%	10 %	-2%
-4%	-1%	32%	-10 %	7%	-16 %	32%	2%	-3 %	21%	3%	9%	16%	-13 %	18 %	1%	10 %	77%	2%
6%	7%	2%	18 %	4%	8%	0%	16 %	9%	1%	0%	-5%	-8%	14 %	1%	-3%	-2%	2%	24%

Appendix F: Average correlation levels between ARPs
Source: Orion Financial Partners

Endnotes

1. In market neutral portfolios, the allocations of the long and the short legs are determined from their respective exposure to market risk (i.e. their beta), whereas dollar neutral portfolios are of equivalent dollar value.
2. i.e. decorrelated from market risk.
3. As being pricing elements on the right-hand side of factor models derived from the CAPM.
4. Asness, Frazzini et Pedersen (2013) measure the quality of a company by four criteria: its profitability, its growth, its safety and the stability of its earning distributions. Each of these criteria is evaluated from different measures (e.g. profitability is measured by the gross margin,ROE, ROA).
5. That is the risk of misclassifying the securities.
6. Equally-weighted, risk parity, score weighting, capitalization weighting.
7. Sector or geographic neutrality, orthogonalization to given factors, Sharpe ratio maximization…
8. Assuming that (i) these two investment universes are each divided in two groups (long and short leg), that (ii) long and short portfolios are equally-weighted, and that (iii) the remaining parameters are similar, these two ARPs will only have, at most, 8.3% of their allocation in common (50/600).
9. The historical performances of ARPs offered by investment band encompass significant part of backtested performances, and therefore incorporate potential biases (Naya and Tuchschmid, 2018).
10. For instance, the market exposure of trend following strategies varies through time, being alternatively net long or net short.
11. In the M&A premium for example.
12. See Naya and Tuchschmid (2018).
13. Not in factor construction, but rather in the allocation between the various risk premia.
14. Long-only and mainly applied to equity markets, marginally to credit or rates.
15. Our database contains 400 ARPs We however excluded multi asset class asset and multi-factor indices.
16. In number of ARPs, not in volume. As ARPs are generally packaged under total return swaps, the amounts managed by the various entities are not available.
17. We consider 3 market environments: for the entire sample, for bullmarket periods and for down market periods (defined in Appendix A).
18. Over the same period, HFRI index (investable and non-investable hedge funds) exhibits a risk/return profile that is in line with that of ARPs.
19. This statement is reinforced using the HFRX index (investable). The same analysis on the HFRI index over the same period confirms the sensitivity of hedge fund returns to crisis periods (+10.1% of annualized performance in bull markets vs. -10.7 in bear markets).
20. The skewness of a statistical distribution measures its symmetry. A positive (negative) skewness implies an asymmetric distribution on the right (left), with extreme events more frequent on the right (left) of the distribution, the skewness of gaussian distributions being equal to 0.
21. The kurtosis of a distribution measures the thickness of its tails. A kurtosis greater than 3 (or a positive excess kurtosis) implies that the tails of the distribution are thicker than those of a Gaussian distribution, which results in a probability greater occurrence for extreme events (both positive and negative).
22. The type of premia remaining different, e.g. between equity momentum vs. equity quality.
23. The lines swapped are the principle vehicles used to access the ARP dveloped by the banks, under th eindices form.
24. Naya and Tuchschmid (2018).

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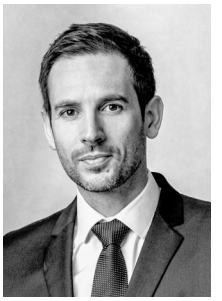

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