Dynamic Strategy Migration and the Evolution of Risk Premia*

David E. Kuenzi
Senior Portfolio Manager, Senior Research Scientist

AlphaSimplex Group, LLC
255 Main St., 10th Floor
Cambridge, MA 02142

dkuenzi@alphasimplex.com

Phone: (617) 475-7132

October 4, 2018

Abstract

We create a conceptual model for risk premia strategies, focusing on the notion of a continuum running from "pure alpha" to "pure beta" and where on this continuum a given manager or investor would like to engage with the markets. We suggest that a risk premium that is nearly completely unknown is really a source of alpha, which then becomes more risk premia-like as it gains market acceptance. As such, there is an inexorable pull toward commoditization for any known and profitable investment strategy. Key questions for both risk premia asset managers and investors is how to operate in this dynamic environment. The investment manager might consider how to adapt and perhaps research and migrate to new, less-commoditized strategies over time. The investor must decide what mix of managers along this continuum to select. Finally, we provide empirical evidence that naïve versions of some of the most known risk premia strategies have indeed shown signs of commoditization in the post-crisis period as compared to the pre-crisis period. Broadly, we suggest that in the face of investment strategy degradation, investors and managers must consider adaptive approaches to the markets and to upgrading their strategies or strategy allocations.

*The views and opinions expressed in this article are those of the author only, and do not necessarily represent the views and opinions of AlphaSimplex Group or any of its affiliates or employees. The author makes no representations or warranty, either expressed or implied, as to the accuracy or completeness of the information contained in this article, nor is he recommending that this article serve as the basis for any investment decision—this article is for information purposes only. The author is grateful to AlphaSimplex, as use of AlphaSimplex data and infrastructure made the analysis in this article possible.

Alternative risk premia strategies have garnered significant attention in recent years. These strategies attempt to provide investors with a diversifying return stream by taking a rules-based approach to strategies that have traditionally been the domain of hedge funds. Such strategies include currency carry, fixed income carry, various forms of trend and momentum, volatility risk premia harvesting, merger arbitrage, long / short equity factor portfolios, and many other strategies. Risk premia managers generally provide these strategies at substantially lower fees than hedge funds. A combination of diversifying hedge fund-like exposures combined with lower fees has made them highly desirable for institutional investors. If we assume that there is a continuum running from "pure alpha" to "pure beta,"[1] a natural question is where on this continuum a particular risk premia strategy is situated. Investors and asset managers must ask themselves just how much "alternatives" and how much "beta" is attached to a given strategy. While these strategies are perhaps more diversifying in a broader portfolio context than equities or credit, just how diversifying are they expected to be over the medium to longer term?

These questions become even more difficult to answer when we consider that the nature of these strategies is likely to change over time. As argued by Lo [2015] and Kuenzi [2007], among others, alpha tends to move toward beta over time. Alpha tends to become alternative risk premia and to then become something more akin to actual beta. Kuenzi [2007], for example, details how this has been the case for generic volatility exposure. In the 1970s, those who understood the Black Scholes options pricing equation and related Greeks were able to generate significant genuine alpha. Today, one can capture a very simple volatility risk premium by simply selling variance swaps; delta-hedged options have become fully commoditized. The

[1] Carhart, et al. [2014, p. 24] describe "exotic betas" as "existing on a continuum—a 'spectrum'—between alpha and the ubiquitous equity factor."

question, then, with any strategy (whether an alpha strategy or a risk premia strategy) is where it lies on the continuum between pure alpha and pure beta. In many ways, a risk premia strategy is not the same strategy one year to the next as underlying markets change, as the liquidity of the instruments used shifts, as the behavior of other non-risk premia market participants changes, and (most importantly) as new market participants enter the space to take advantage of this risk premium. In short, there is an inexorable pull toward efficiency, commoditization, and beta over time.

Another area that requires deep consideration, then, is not just where a particular strategy lies on this continuum between alpha and beta, but where both investors and money managers want to situate themselves as they search for returns. Investors and managers should also be asking which strategies are of most interest at a particular node along the continuum. Similarly, they should be asking themselves how this inexorable pull toward beta should be managed.

In what follows, we first provide further insight into the drivers of this pull toward beta. Second, we provide a conceptual schematic for considering how different money managers might position themselves with regard to new strategy development in this context. Finally, we provide an example of this pull toward beta and the implications this has for innovation, new strategy development, and strategy timing.

Drivers of the Pull toward Beta

A key, non-technical term that is helpful in thinking about this pull toward beta is what we call "run-for-the-exit risk." This is the risk that market participants exposed to a financial instrument, group of instruments, or trading strategy will all seek to exit that instrument, group of instruments, or trading strategy simultaneously, thus potentially driving substantial losses. We can think of this concept of "run-for-the-exit risk" as being highly related to both equity beta and crowding, both of which exhibit run-for-the-exit risk. Crowding suggests that there is a typically temporary interest in a security or group of securities that makes these securities at risk of a severe reversal.[2] Equity beta can be thought of as a more direct exposure to the broader equity markets (or to the global risk factor). While positions or portfolios that involve either crowding or equity beta have run-for-the-exit risk by definition, there may also be strategies that are not necessarily crowded and that are not necessarily equity-related by nature, but that have the risk of a simultaneous exit of market participants and ensuing substantial losses.

We argue that run-for-the-exit risk may be either a known condition or an unknown condition. The quant equity meltdown in August 2007 is an example of run-for-the-exit risk that seemed to be fairly unknown to the markets until the unwind occurred.[3] Currency carry is a strategy that

[2] Khandani and Lo [2007] and Cahan and Luo [2013], for example, explore crowding in the context of the equity market neutral strategy in August 2007, while Pojarliev and Levich [2011] and Konstantinov [2017] explore crowding in the context of FX markets. Perhaps most pertinent is Baltas (2018), which is more squarely focused on alternative risk premia strategies. However the author takes a somewhat different approach, discussing the notion of crowding as a function of time, whereas we are more focused on crowding as related to the ongoing awareness of, interest in, and attention to a given strategy.

[3] Khandani and Lo [2007, p. 3] note that one reason for the severe unwind in factor-based equity market neutral strategies was a "lack of awareness (at least prior to August 6, 2007) of just how crowded the long / short equity category had become." We would consider "crowding," in this sense, to be synonymous with an increase in run-for-the-exit risk.

has run-for-the-exit risk; while this run-for-the-exit risk also exhibits equity beta, it is only tangentially related to equity markets in any direct sense (perhaps because higher interest rate countries may be more exposed to the global economic cycle). But as with equities, it is a risk premium that is perhaps perpetually crowded;[4] it is, perhaps, simply a risk premium (like the equity risk premium) that many market participants would like to be exposed to.

One of the key points of learning from the global financial crisis of 2008 - 2009 is that smart trades (strategies with a positive return expectation and that involve some risk) are subject to being summarily liquidated by multiple managers as markets sell off—and certainly in a crisis. This then reinforces the risk-on / risk-off behavior (and hence the run-for-the-exit risk) of many investment approaches that involve both risk-taking and a risk premium. As markets begin to look shaky, managers not only take off direct exposure to equities and high-yield bonds, but they also begin to reduce exposure to merger arbitrage trades, carry trades, and other known (and perhaps lesser-known) risk premia trades.

The Adaptive Markets Hypothesis[5] suggests that traders and portfolio managers do not necessarily optimize their trading strategies in a highly precise sense, but that they adapt and change in order to survive.[6] Post crisis, one of the adaptations has been to treat many known active strategies as having an inherent run-for-the-exit risk. The thinking among traders and portfolio managers is that lots of profit-seeking investors will move to safe investments (i.e.,

[4] Konstantinov [2017] finds evidence of substantial crowding into the currency carry strategy among international bond funds.
[5] See Lo [2012].
[6] See also Lo [2004], in which the author notes that "while profit maximization, utility maximization, and general equilibrium are certainly relevant aspects of market ecology, the organizing principle in determining the evolution of the markets is simply *survival*."

cash) when markets start to quake. So it makes sense to begin selling preemptively when risk markets are in the earlier stages of a selloff. As such, even in trading a strategy that is inherently disconnected from equities, market participants are more likely to take down risk in an equity selloff. This tendency will increase when there is any systemic risk in the air. This then imbues these strategies with a beta-like characteristic. The period around the European debt crisis is an outstanding example. The increased perceived systemic risk during that period led to very high correlations across both asset classes and across various trading strategies.

In a sense, we could say that the more known a particular trading strategy is, the more "beta" it is likely to have. The more known a trading strategy is, the greater the run-for-the-exit risk if the trade begins to perform poorly. Equities largely define the collective idea of "market beta" because it is an asset class that is 1) attached to global economic performance, and 2) dominates global investment portfolio risk allocation. If investors around the world want to take off risk to the global economy, the primary way of doing so is to reduce equity exposure—the most known and prevalent strategy of all. This then, in a sense, is the ultimate run-for-the-exit risk.

Another way to frame this pull toward beta is to consider the drivers of what we call "alpha." Most of what we call alpha consists of systematic mispricings in the market due to behavioral biases, institutional constraints, or compensation (sometimes over-compensation) for an undesirable risk—for providing liquidity to the marketplace. These mispricings can be considered alpha so long as very few managers are aware of them.[7] Once they begin to become

[7] There are indeed some other sources of alpha, such as pure market timing or factor-neutral security selection. These sources of alpha are, however, notoriously difficult to obtain even for the most skilled managers. Truly prescient market timing, for example, never becomes beta. It will always be a source of pure, uncorrelated alpha. Security selection (independent of factor exposure tilts) is similar. Again, these sources of alpha are just very

known, more money chases these opportunities, which then drives two phenomena: 1) the level of "alpha" deteriorates, and 2) it becomes more correlated with the global risk factor; it becomes more beta-like. It becomes more beta-like because the "run-for-the-exit" risk increases as more market participants adopt that particular strategy. (Note that some strategies may have less run-for-the-exit risk by the nature of how they are constructed and operate, such as trend following.)

A Conceptual Framework for Investment Managers and Investors

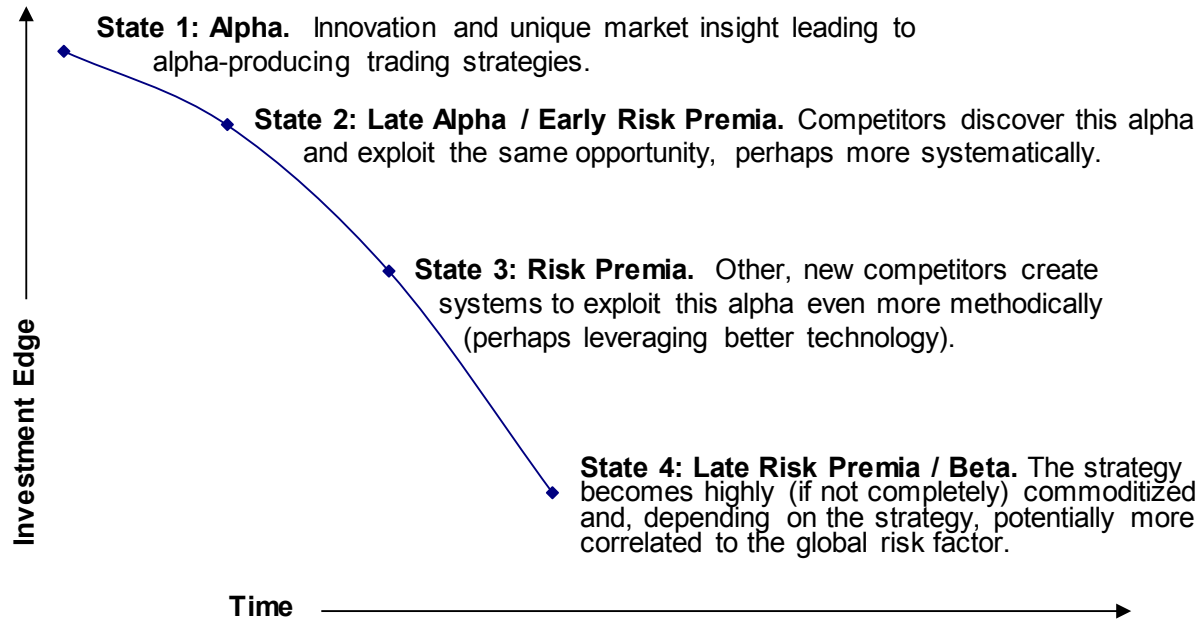
In a world in which alphas continuously sink down a slope toward betas, investment managers need to determine where on this scale they want to operate and the extent to which they may want to dynamically migrate to higher value-added strategies as existing strategies become better known. By the same token, investors need to determine where along this continuum they want to invest. From the manager's perspective, it's a question of philosophy and capabilities. From the investor's perspective, this decision involves philosophy about the markets but also much more. It involves the quest for diversification and return and perhaps diversification across alpha, alternative risk premia, and more commoditized risk premia strategies. The investor may wish to take multiple approaches. Regardless, it is helpful to build a conceptual model of alpha, risk premia, and late risk premia / beta, so as to analyze the opportunity set more clearly.

In order to do this, we first consider the stages of alpha, alternative risk premia, and late risk premia / beta, as shown in Exhibit 1. We define “Investment Edge” as either alpha or a risk

difficult to achieve. In this article, we are more interested in systematic mispricings that are somewhat known and can be exploited through automation or that are less known and perhaps more immediately difficult to exploit through automation but for which such automation is indeed possible.

premium that is uncorrelated to the global risk factor (to equities). State 1 occurs when a small number of market participants (perhaps a small group of hedge funds) are able to identify market anomalies that others are not yet aware of. This becomes a source of differentiated alpha. As more and more similar managers become aware of this source of alpha, it begins to erode, leading to State 2. This could be considered a state where the anomaly is known mostly among highly informed managers. This transparency into the strategy now draws in managers whose goal it is to fully automate the capture of various sources of return, which leads to State 3. At this stage, the strategy attracts both more investment capital and further automation until it becomes yet more commoditized, which produces State 4.

Exhibit 1
Movement from Alpha to Risk Premia to Late Risk Premia / Beta



Based on this representation of anomaly-based trading strategies, the natural questions are:

- Where are the strategies that I am currently exposed to situated on this scale?
- Where are the strategies that are of most interest looking forward situated on this scale?

- Do certain risk premia strategies ever die altogether?[8]
- In this world, aren't risk premia strategies likely to increase in importance, to hold a place alongside other popular active strategies?

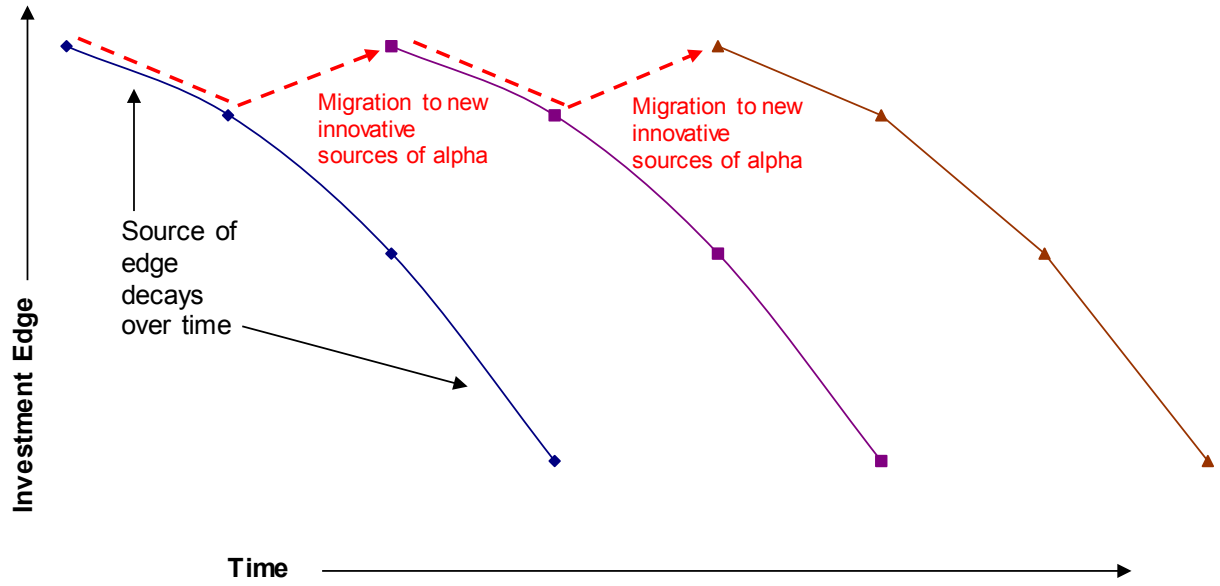
The first two questions are context specific. We address the third question in future paragraphs. The answer to the fourth question is probably "yes;" risk premia strategies are likely to continue to gain in popularity, becoming as important as hedge funds and other active strategies, as they embody a desirable mix of both active and passive characteristics.[9]

For a top tier hedge fund, it is critical to always be on the look-out for new sources of pure alpha because it is only a matter of time before existing alpha deteriorates and becomes another risk premium. As more managers discover the strategy, levels of returns and risk-adjusted returns are likely to decrease, and it will likely inherit increasing levels of run-for-the-exit risk, becoming more beta-like. Exhibit 2 depicts this approach. This approach requires a highly-organized, extraordinarily skilled, and well-resourced investment team, as well as an ongoing commitment to researching new market anomalies, along with a willingness to abandon profitable strategies that had previously been highly profitable. Few managers can consistently compete successfully in this arena. Given that new alpha strategies are by their very nature unproven, the potential for these managers to commit capital to strategies that ultimately do not work is high.

[8] Baltas [2018, p. 13] poses the same question and suggests that risk premia strategies "constitute the outcome of a rational risk-sharing mechanism or irrational cognitive bias," and that "crowding has to somehow economically impact rational and irrational investor preferences for the various ARP to shrink or potentially disappear," and thus casts doubt on whether they will indeed shrink or disappear. As is commonly discussed in the industry, we believe that risk premia are driven by 1) structural effects, 2) behavioral biases, and 3) compensation for a known risk. We believe that naïve risk premia that are primarily driven by items 1 and 2 can indeed shrink substantially based on crowding.

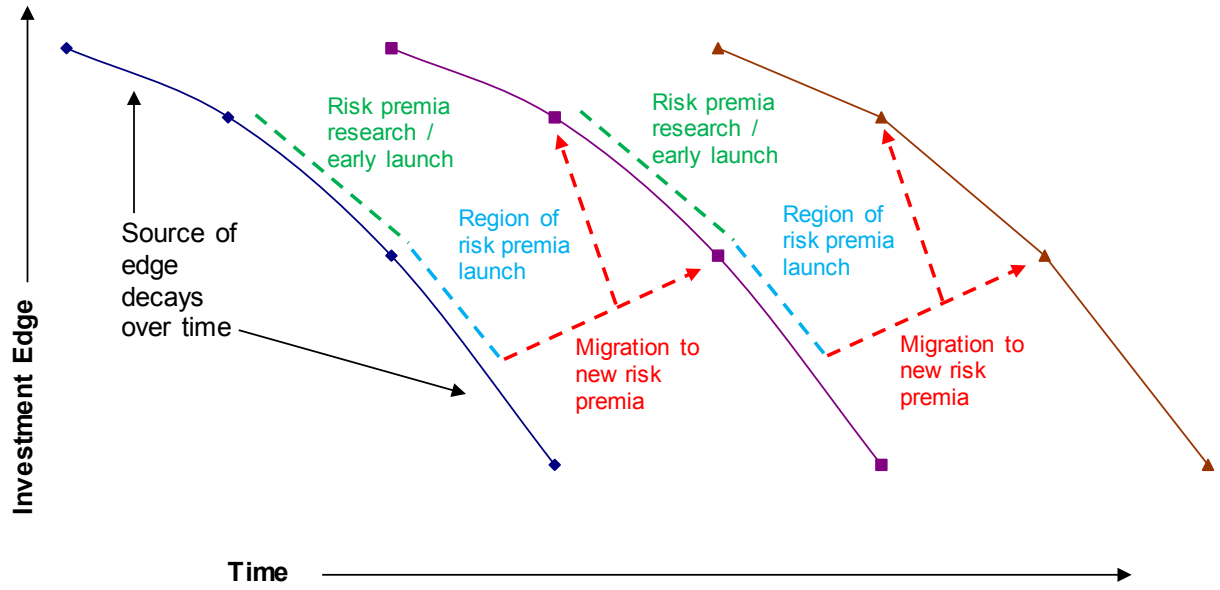
[9] Lo [2015] notes that "automated trading technologies" and "benchmark algorithms for high-performance computing" have "blurred the line between passive and active."

Exhibit 2
Continual Migration to New Sources of Alpha



Risk premia managers must also assess whether a given strategy continues to provide an acceptable level of excess return—whether returns associated with behavioral biases, structural effects, or compensation for a non-market risk are still sufficient. If the risk premium associated with a particular strategy erodes sufficiently, then the risk premia manager must also migrate to new risk premia strategies. This is depicted in Exhibit 3. A critical concern with risk premia strategies is where they are in relation to more standard market betas; if, for example, the strategy provides a return generally commensurate with its beta to equities, then it becomes much less useful as a component of a diversified portfolio. Additionally, the time afforded to a risk premia strategy before a more base level of late risk premia / beta takes hold is likely longer than the time afforded before alpha strategies deteriorate and become risk premia.

Exhibit 3
Continual Migration to New Sources of Risk Premia

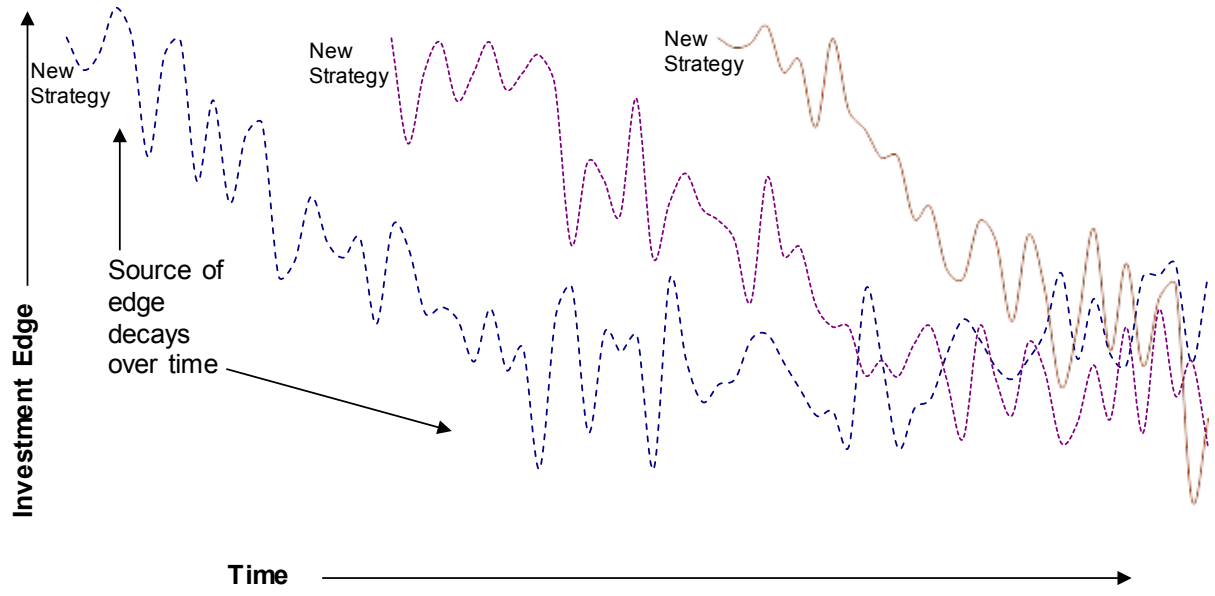


Another issue is how far toward the alpha end of the spectrum the risk premia manager wants to engage. There is a big difference between adopting existing and known risk premia strategies on the one hand and trying afresh to automate existing and lesser-known discretionary alpha strategies on the other. A focus on existing and known strategies will require less research, as there will likely be plenty of existing papers and other available research on the strategy. A focus on automating lesser-known discretionary strategies will require much more in the way of research and innovation as well as an additional level of uncertainty and risk regarding the strategy's ability to generate excess returns. Again, where along this spectrum a given manager wants to compete is a critical decision, as it has implications for resources and research focus.

Additionally, the level of excess return associated with these risk premia can fluctuate both up and down in various market environments. The Adaptive Markets Hypothesis suggests that markets are basically efficient, but that they can become more or less efficient depending on the

market environment. Similarly, it suggests that "investment strategies will wax and wane, performing well in certain environments and performing poorly in other environments." (See Lo [2004], p. 24.) From this perspective, while many trading strategies move toward beta over time, they do not do so in a purely linear fashion, but rather can show more or less promise as a function of the market environment. As such, Exhibit 4 is perhaps the more accurate stylized representation of the movement toward late risk premia / beta over time. Once alpha has generally disappeared altogether and the inherent risk premium begins to dissipate, we are left with fluctuations between something akin to beta and something a little bit better.

Exhibit 4
Strategy Decay with Noise



This then leads to two questions:

1) How and when should strategies be retired, so that the progression depicted in Exhibit 3 can be achieved somewhat seamlessly over time?
2) Should managers consider timing risk premia strategies? If the level of excess returns is a function of time, then ideally one would want time varying exposure to these strategies.

There are a number of frameworks for answering the first of these questions. Sabar [2015], for example, proposes a Bayesian approach whereby a given strategy is initially assigned probabilities associated with its mapping to several strategy types (each strategy type is associated with a particular Sharpe ratio level / deterioration path). The strategy's probabilities associated with these various Sharpe ratio regimes then undergo Bayesian updating as new performance data becomes available. While further details around the process for retiring strategies is beyond the scope of this article, suffice it to say that this is an important consideration that risk premia managers (as well as pure alpha-seeking managers) must consider.

The second issue, around risk premia strategy timing, is also very important. Clearly, there are some risk premia that have a more medium- to long-term mean-reverting nature and are therefore more given to timing strategies (e.g., most carry strategies, vol risk premia capture, etc.), while others (e.g., trend following) are not. So it may make sense to attempt to time strategies that have been around for some time and for which the actual risk premia available in a given market environment, or the inherent opportunity, can be estimated. This will arguably continue to be an area of substantial research during the next few years.[10]

[10] Several authors have written on this topic, mostly with regard to equity cross-sectional alternative risk premia. Among them, Miller, et al. [2015, p. 46] "find that significant economic benefits accrue to dynamic factor weighting." Similarly, Kahn and Lemmon [2015, p. 78] note that active returns come from three areas: "returns from constant exposures to smart-beta factors," returns from "timing those factors," and returns from "manager skill, above and beyond those factors." Arnott et al. [2016] suggest that smart beta timing strategies based on relative valuations are indeed valid, while Asness et al. [2017] suggest that this approach is not generally helpful. Finally, Hodges, et al. [2017] and Bender, et al. [2018] point to the use of a sufficiently long time frame as helpful in timing factor returns and / or the use of multiple predictors.

Analysis of 16 Naïve Risk Premia Strategies

Now we turn to the data to see if the stylized observations in the previous section are observable among actual risk premia strategies. One of the more known clusters of risk premia is a group of 16 strategies formed by taking four traditional approaches to risk premia (carry, momentum, trend, and value) and applying these to futures and FX forwards markets within four asset classes (bonds, commodities, equities, and FX). We explore a sub-set of these strategies in order to identify the extent to which strategy decay has occurred. The strategies and a brief description of each is included below.

Exhibit 5
List of Risk Premia Strategies[11,12]

[11] Note that for most of these strategies we apply an instrument weighting scheme whereby the strongest positive signal is assigned the largest positive weight, the second strongest positive signal is assigned the second largest positive weight, and so forth. The unscaled weight vector h is obtained from the raw strategy signals as:

$$\mathbf{h} = \text{rank}(\mathbf{Signal}) - \frac{1 + nInstruments}{2}$$

, where Signal is a vector of raw signals and nInstruments is the total number of instruments traded in the strategy. A five-instrument strategy, for example, would have weights proportional to [-1 -0.5 0 0.5 1]. The final weight vector for the strategy (w) is obtained by multiplying h by a constant k that will result in a strategy ex-ante annualized volatility target of 10%. All strategies except the trend strategies utilize this weighting mechanism and are thus "neutralized" to a given market. Signals in the trend strategies are set to either +1 or -1. Note that all strategies have been constructed to target a 10% annualized ex-ante volatility based on the trailing 252-day volatility of the strategy.

[12] We include 14 of the 16 potential strategies in the risk premia category by asset class grid. Specifically, we exclude Bond Value and Commodity Value, as there is no readily apparent way to robustly identify "value" in these asset classes (except perhaps in a fashion that is already represented within the Bond Carry and Commodity Carry strategies). The list of futures and FX forward contracts used in each of these strategies is shown in the appendix.

Strategy	Description
Bond Carry	Long the 10-year bond in countries with the steepest sovereign yield curves (2s10s spread) and short the countries with the flattest.
Commodity Carry	Long the most backwardated commodities and short the least backwardated commodities.
Equity Carry	Long the highest dividend yielding national equity markets and short the lowest dividend yielding national equity markets.
FX Carry	Long the currencies with the highest short interest rate and short the currencies with the lowest short rate.
Bond Momentum	Long the sovereign 10-year bond markets with the most postive returns in the eleven months preceding the most recent month, and short those with the lowest return over the same period.
Commodity Momentum	Long the commodities with the most postive returns in the eleven months preceding the most recent month, and short those with the lowest return over the same period.
Equity Momentum	Long the national equity markets with the most postive returns in the eleven months preceding the most recent month, and short those with the lowest return over the same period.
FX Momentum	Long the currencies with the most postive returns in the eleven months preceding the most recent month, and short those with the lowest return over the same period.
Bond Trend	Long a given sovereign 10-year bond market if the 5-day moving average of the contract price is above the 178-day moving average, and short if the 5-day moving average is below the 178-day moving average.
Commodity Trend	Long a given commodity if the 5-day moving average of the contract price is above the 178-day moving average, and short if the 5-day moving average is below the 178-day moving average.
Equity Trend	Long a given national equity market if the 5-day moving average of the contract price is above the 178-day moving average, and short if the 5-day moving average is below the 178-day moving average.
FX Trend	Long a given currency if the 5-day moving average of the contract price is above the 178-day moving average, and short if the 5-day moving average is below the 178-day moving average.
Equity Value	Long the national equity markets with the lowest price-to-book ratios and short those with the highest price-to-book ratios.
FX Value	Long the currency market that are selling below purchasing power parity, and short currency markets that are above purchasing power parity.

We perform our analysis over the 25 and one-half year period running from January 4, 1993 to June 29, 2018. In performing the ensuing analysis, we consider a variety of performance statistics in the period after the financial crisis as opposed to in the period preceding the financial crisis. We find that the crisis / crisis recovery period produced either very strongly positive or very strongly negative returns for many of these strategies; including it, therefore, reduces our

ability to determine whether an overall decay in strategy performance has occurred. We therefore divide the 25.5 year history into three components: pre-crisis (January 4, 1993 to June 29, 2007), crisis (July 2, 2007 to December 31, 2009), and post-crisis (January 2, 2010 to June 29, 2018). As such, we have a 14.5-year pre-crisis period, a 2.5-year crisis / crisis recovery period, and an 8.5-year post-crisis period. Again, our focus is on strategy performance in the pre-crisis environment as compared to the post-crisis environment.

Exhibit 6 shows a variety of return statistics for these strategies in the pre-crisis period (columns A through D) and the post-crisis period (columns E through H).[13] These results are nicely summarized in the final six columns of the table. Columns I and J highlight the difference in the annualized returns during the two periods. Returns for 13 of the 14 strategies are lower in the post-crisis period; three of these changes are statistically significant at the 5% level. The change in risk-adjusted returns is even more stark. Columns K and L show that Sharpe ratios for 13 of the 14 strategies decreased from the pre-crisis period to the post-crisis period, and eight of these changes were statistically significant at the 5% level.[14] Somewhat counter to the notion of strategy degradation, however, the Sharpe ratio of one of the strategies (Commodity Carry) was statistically significantly higher. The overall results, however, point to a substantial downward shift in both returns and Sharpe ratios.

[13] Returns are derived from investment in continuously rolled futures and FX forward contracts and assume notionally funded portfolio (i.e., there are no cash returns / cash return assumptions included in the return streams). We remove transaction costs, which include commissions, one-half the estimated bid / ask spread, and impact, which are scaled by country, exchange, size of contract, etc. All data for this analysis come from Bloomberg, except for the purchasing power parity data, which comes from the OECD.

[14] For computing the standard errors of the Sharpe ratios, we use the methodology proposed in Lo [2002].

Exhibit 6
Changes in Strategy Basic Statistics—Pre-Crisis versus Post-Crisis

	Pre-Crisis Period: Jan 1993 - June 2007				Post-Crisis Period: Jan 2010 - June 2018				Return Difference		Sharpe Ratio Difference		Correlation Difference	
Strategy	(A) Mean Annualized Return	(B) Standard Deviation	(C) Sharpe Ratio	(D) Correlation to S&P 500	(E) Mean Annualized Return	(F) Standard Deviaion	(G) Sharpe Ratio	(H) Correlation to S&P 500	(I) Difference in Returns	(J) P-Value: Difference in Returns	(K) Difference in Sharpes	(L) P-Value: Difference in Sharpes	(M) Difference in Correlations	(N) P-Value: Difference in Correlations
Bond Carry	5.2%	9.9%	0.53	-0.04	4.3%	10.0%	0.43	-0.19	-0.9%	0.42	-0.10	0.34	-0.15	0.00
Commodity Carry	2.7%	10.8%	0.25	0.02	8.2%	10.2%	0.81	0.07	5.5%	0.88	0.56	1.00	0.05	0.91
Equity Carry	2.4%	10.0%	0.24	0.00	-3.7%	10.3%	-0.36	0.09	-6.0%	0.08	-0.59	**0.00**	0.09	**0.99**
FX Carry	7.8%	10.0%	0.78	0.18	0.0%	10.5%	0.00	0.48	-7.8%	**0.04**	-0.78	**0.00**	0.30	**1.00**
Bond Momentum	0.7%	9.9%	0.07	-0.04	0.7%	9.8%	0.07	-0.09	0.0%	0.50	0.00	0.49	-0.06	0.06
Commodity Momentum	6.5%	10.7%	0.61	-0.04	5.2%	10.4%	0.50	0.08	-1.3%	0.39	-0.11	0.33	0.11	**1.00**
Equity Momentum	-0.8%	10.3%	-0.08	0.02	-4.4%	10.1%	-0.44	0.05	-3.6%	0.19	-0.36	**0.04**	0.03	0.79
FX Momentum	4.0%	10.4%	0.39	0.00	0.5%	9.8%	0.05	0.16	-3.5%	0.21	-0.33	0.08	0.16	**1.00**
Bond Trend	6.9%	10.4%	0.66	-0.07	1.2%	10.3%	0.12	-0.30	-5.7%	0.11	-0.55	**0.01**	-0.22	0.00
Commodity Trend	5.3%	11.0%	0.48	-0.04	-0.6%	10.3%	-0.06	-0.03	-5.9%	0.10	-0.54	**0.00**	0.01	0.58
Equity Trend	5.4%	10.7%	0.50	0.07	-3.8%	10.1%	-0.38	-0.03	-9.2%	**0.02**	-0.88	**0.00**	-0.09	0.01
FX Trend	4.7%	12.4%	0.38	-0.06	1.0%	12.3%	0.08	0.01	-3.7%	0.25	-0.30	0.07	0.06	**0.96**
Equity Value	6.6%	10.1%	0.65	-0.19	-1.4%	10.3%	-0.14	0.19	-8.0%	**0.04**	-0.79	**0.00**	0.38	**1.00**
FX Value	5.3%	10.2%	0.52	0.22	1.5%	12.0%	0.13	-0.10	-3.8%	0.23	-0.39	**0.05**	-0.32	0.00

Finally, as shown in columns M and N, nine of the 14 strategies had higher correlations to the S&P 500, with six of these increases being statistically significant at the 5% level.[15] Again, and contrary to the notion that strategies become more correlated to the market risk factor as they become more known, four of these strategies actually showed significant decreases in correlation to the S&P 500. We also note that the absolute level of these correlations is quite low.

This last result deserves more attention. One of the key aspects of the previously described "run-for-exit risk" is that it is most acute when the markets are selling off. In other words, the returns of many strategies may seem somewhat independent of broader equity market returns in flat to positive market environments but become much more correlated in the event of a sell-off. To explore this, we take correlations between each strategy and the S&P 500, but using only those weeks for which the S&P 500 is down more than 3%. The results of this analysis (Exhibit 7) are somewhat stronger than shown in the previous correlation analysis, with overall higher levels of correlation, 11 of the 14 strategies showing an increase in correlation, and eight of those to a degree that is statistically significant at the 5% level. We would also argue that true run-for-the-exit risk may only manifest itself in yet more extreme market environments. Overall, the results are broadly consistent with the notion of increasing correlations to equities and thus increasing run-for-the-exit risk. We note, however, that while correlations have shown a statistically significant increase, they are still quite low on an absolute basis, especially for the trend following and value strategies.

[15] For all computations of correlation and beta, we aggregate daily return data into weekly return data and then compute correlations or betas as needed using this weekly data. We do this in order to avoid problems with asynchronous pricing across global markets, which tend to have varying trading hours.

Exhibit 7
Pre-Crisis and Post-Crisis Conditional Correlations

Strategy	Conditional Correlation Early Period	Conditional Correlation Late Period	Difference in Conditional Correlations	P-Value: Difference in Correlations
Bond Carry	-0.12	0.12	0.24	**1.00**
Commodity Carry	0.09	0.29	0.20	**1.00**
Equity Carry	0.05	0.17	0.12	**1.00**
FX Carry	0.21	0.26	0.04	0.88
Bond Momentum	-0.15	0.24	0.39	**1.00**
Commodity Momentum	-0.07	0.23	0.30	**1.00**
Equity Momentum	-0.14	0.05	0.19	**1.00**
FX Momentum	0.07	0.11	0.04	0.84
Bond Trend	0.07	0.01	-0.06	0.05
Commodity Trend	-0.03	0.08	0.11	**1.00**
Equity Trend	-0.21	-0.23	-0.02	0.26
FX Trend	-0.19	-0.15	0.04	0.88
Equity Value	-0.57	0.07	0.65	**1.00**
FX Value	0.41	-0.06	-0.48	0.00

Given that on balance correlations of these strategies to the S&P 500 have increased, it makes sense to consider the extent to which their returns have deteriorated after adjusting for exposure to stocks. To do this, we compute a rolling 26-week beta of each strategy to the S&P 500 and then compute each strategy's weekly beta-adjusted returns as $r_{t,j}^{Adj} = r_{t,j} - \beta_{t,j} \cdot r_{t,S\&P500}$, where $r_{t,j}^{Adj}$ is the beta-adjusted return of strategy j on day t, and $r_{t,j}$ is the return of strategy j on day t.

The results, shown in Exhibit 8, are largely consistent with the results regarding non-beta-adjusted returns in Exhibit 6. Twelve of the 14 strategies exhibit lower beta-adjusted returns, and three of those decreases are statistically significant. Note that while the general trend has been toward lower beta-adjusted returns and that six of the strategies had negative beta-adjusted returns post-crisis, four (and perhaps five) of the strategies had large and quite healthy beta-adjusted returns. This is consistent with the stylized representation of strategy decay shown in Exhibit 4, which suggests that commoditized risk premia strategies are likely to provide a return

consistent with their exposure to the global risk factor or perhaps a bit better, depending on the market environment.

Exhibit 8
Pre-Crisis and Post-Crisis Beta-Adjusted Returns

Strategy	Beta-Adjusted Return Early Period	Beta-Adjusted Return Late Period	Difference in Beta-Adjusted Returns	P-Value: Difference in Returns
Bond Carry	5.6%	5.4%	-0.2%	0.48
Commodity Carry	4.1%	7.4%	3.3%	0.75
Equity Carry	2.1%	-2.4%	-4.5%	0.10
FX Carry	6.5%	-4.6%	-11.1%	**0.00**
Bond Momentum	1.0%	1.3%	0.3%	0.54
Commodity Momentum	5.7%	5.3%	-0.4%	0.47
Equity Momentum	-1.5%	-7.0%	-5.4%	0.07
FX Momentum	3.6%	-2.4%	-6.0%	0.08
Bond Trend	5.4%	4.5%	-0.9%	0.43
Commodity Trend	4.4%	0.6%	-3.8%	0.21
Equity Trend	2.0%	-5.9%	-7.9%	**0.02**
FX Trend	5.2%	1.0%	-4.2%	0.22
Equity Value	6.2%	-3.6%	-9.8%	**0.01**
FX Value	4.5%	2.8%	-1.7%	0.37

Finally, we implement the methodology used in McLean and Pontiff (2013) (which they employed in the context of determining whether market anomalies deteriorate after publication of related research) in order to take a more robust look at the extent to which the returns of these risk premia strategies may have decreased from the pre-crisis period to the post-crisis period. The first step is to scale all returns by the mean return in the pre-crisis period ($R_{t,j} = r_{t,j} / \overline{r^{Pre}_{t,j}}$). We then perform the following regression:

$$R_{t,j} = b_{Pre} + b_{Crisis} D^{Crisis}_{t,j} + b_{Post} D^{Post}_{t,j} + e_{t,j} \quad (1)$$

where $D^{Crisis}_{t,j}$ is a dummy variable set to 1 if day t is during the crisis / crisis recovery period, and 0 otherwise, and $D^{Post}_{t,j}$ is a dummy variable that is equal to 1 if day *t* is in the post-crisis period

and 0 otherwise.[16] This approach allows us to interpret the b_{Post} coefficients as an estimate of the post-crisis period's return as a fraction of the pre-crisis period's return. (The intercept is effectively an estimate of the pre-crisis return as a fraction of itself; we note that it is correctly estimated at unity.) The results of this analysis are shown in Exhibit 9.

Exhibit 9
Coefficients and T-Statistics for Period Returns Regression

Strategy	Raw Returns		Beta-Adjusted Returns	
	Intercept	Post Crisis	Intercept	Post Crisis
Bond Carry	1.00	-0.17	1.00	-0.03
	(1.96)	(-0.21)	(2.56)	(-0.05)
Commodity Carry	1.00	1.98	1.00	0.78
	(0.97)	(1.17)	(1.40)	(0.66)
Equity Carry	1.00	-2.61	1.00	-2.20
	(0.87)	(-1.39)	(0.97)	(-1.29)
FX Carry	1.00	-1.00	1.00	-1.74
	(2.80)	**(-1.70)**	(2.49)	**(-2.61)**
Bond Momentum	1.00	-0.05	1.00	0.33
	(0.27)	(-0.01)	(0.45)	(0.09)
Commodity Momentum	1.00	-0.19	1.00	-0.07
	(2.29)	(-0.27)	(1.98)	(-0.08)
Equity Momentum	1.00	4.72	1.00	3.69
	(0.29)	(0.84)	(0.68)	(1.51)
FX Momentum	1.00	-0.87	1.00	-1.68
	(1.47)	(-0.78)	(1.34)	(-1.36)
Bond Trend	1.00	-0.82	1.00	-0.17
	(2.43)	(-1.21)	(1.74)	(-0.18)
Commodity Trend	1.00	-1.12	1.00	-0.86
	(1.84)	(-1.26)	(1.51)	(-0.78)
Equity Trend	1.00	-1.74	1.00	-4.01
	(1.89)	**(-2.00)**	(0.85)	**(-2.06)**
FX Trend	1.00	-0.79	1.00	-0.81
	(1.38)	(-0.66)	(1.60)	(-0.79)
Equity Value	1.00	-1.23	1.00	-1.60
	(2.37)	**(-1.77)**	(2.65)	**(-2.56)**
FX Value	1.00	-0.71	1.00	-0.37
	(1.81)	(-0.78)	(1.61)	(-0.36)

[16] We perform the regression using all three periods (as shown in Equation 1) but report only the bPre and bPost so as to keep focus on the discussion at hand. We also ran the regression without the crisis term, which produced nearly identical results, except that the statistical significance of the bPost coefficients were slightly higher in the reduced regression.

The first two columns show results based on raw returns, while the final two columns show results based on beta-adjusted returns. The first thing to note is that 12 of the raw returns are shown to be lower post-crisis. If we look back at Exhibit 6, we can see that one strategy (Equity Momentum) had a negative return in the pre-crisis period and that this strategy's return was substantially more negative in the post-crisis period. This leads to a perverse result in Exhibit 9, where b_{Post} is 4.72, suggesting that the return is 4.72 times higher, when really it is 4.72 times lower. After taking this into account, it is clear that the results with regard to lower mean returns in Exhibits 6 and 9 are consistent with one another (13 strategies with lower returns post-crisis, and three of those statistically significantly so). The beta-adjusted columns are qualitatively the same, except that the statistical significance is a bit stronger.

All in all, our analysis suggests that these strategies (which are arguably among the most known risk premia strategies) have experienced lower returns, lower Sharpe ratios, and lower beta-adjusted returns in the post-crisis period as compared to the pre-crisis period. We note, however, that the deterioration has not led to flat or negative beta-adjusted returns in all strategies, suggesting that there may continue to be opportunities in known strategies depending on how these opportunities are approached. Again, this points to the importance of an active and adaptive approach to both managing and investing in alternative risk premia.

Observations and Conclusions

In a very practical sense, both risk premia managers and investors must grapple with the pull of these strategies toward commoditization and beta. Determining when a strategy has reached a

fully commoditized state is not easy, but must be part of an ongoing analysis and dialogue. Run-for-the-exit risk and outright crowdedness are likely to increase looking forward. Given the potential for risk premia strategies to provide hedge fund-like returns, but typically at a much lower flat fee to investors than charged by hedge funds themselves, it is likely that this segment of the market will continue to grow. Such growth speaks to the importance of the issues outlined in this article, as the commoditization of known risk premia strategies is likely to move apace. This will thereby lead to more emphasis on both the need for innovative approaches to existing strategies, new strategy development, and the potential to tactically allocate to these strategies,[17] as well as on how and when to retire those strategies that have become overwhelmingly commoditized.

Managers of risk premia products as well as investors in these products must consider very carefully how and where to participate in this rapidly changing landscape of alpha, risk premia, and outright beta. For the manager, these decisions have strong implications for the amount and type of resources that must be committed in order to effectively compete. For managers seeking true alpha, this suggests that a highly innovative and dynamic approach to new strategy development is critical. For managers focused on risk premia, this analysis suggests that enhancing existing strategies, research into newer strategies, and potentially strategy timing may be more important. From the investor's perspective, it is important to have conviction with respect to where the most "edge" is available at a given price and how to diversify among these

[17] These directions are fully consistent with the Adaptive Markets Hypothesis (Lo [2004] and [2012]), which suggests 1) innovation is an important element of survival, and 2) that strategies can become more or less efficient as a function of market environment, thus potentially leading to occasional opportunities within more commoditized strategies.

opportunities. From the perspective of both investors and managers, the determination of when to retire strategies (or quit investing in them) is certainly one of the trickier implications.

Overall, increased technological innovation and a much more nimble set of market participants means that the environment for risk premia strategies has become much more dynamic. For investors and money managers focused on this segment of the market to thrive, they must first determine where and how they want to participate with regard to the natural aging of these strategies. Second, they must embrace this dynamism and structure themselves to continually evolve and adapt to an ever-changing market reality.

Appendix

The instruments used within the 14 strategies are shown in the tables below:

Asset Class	Instrument
Bonds	Australian 10-Year Bond Future
	Canadian 10-Year Bond Future
	Euro-Bund Bond Future
	Long Gilt Future
	Japanese 10-Year Bond Future
	U.S. 10-Year Note Future
Commodities	Silver Future
	Cocoa Future
	Coffee Future
	Corn Future
	Cotton Future
	WTI Crude Future
	Live Cattle Future
	Gasoline RBOB Future
	Gold 100 Oz Future
	NY Harbor USLD (Heating Oil) Future
	LME PRI Aluminum Future
	Brent Crude Future
	LME Copper Future
	Low Su Gasoil Future
	LME Nickel Future
	LME Zinc Future
	Natural Gas Future
	Soybean Future
	Soybean Meal Future
	Soybean Oil Future
	Sugar #11 (World) Future
	Wheat Future

Asset Class	Instrument
Equities	IBEX 35 Index Future
	SPI 200 Index Future
	S&P/TSX 60 Index Future
	DAX Index Future
	CAC40 Euro Index Future
	FTSE 100 Index Future
	FTSE/MIB Index Future
	TOPIX Index Future
	Amsterdam Index Future
	OMXS30 Index Future
	S&P 500 E-Mini Future
FX	Australian Dollar Forward
	Canadian Dollar Forward
	Euro Currency Forward
	Brittish Pound Forward
	Japanese Yen Forward
	Swiss Franc Forward
	Swedish Krona Forward
	New Zealand Dollar Forward
	Norwegian Krone Forward

REFERENCES

Arnott, R., N. Beck., and V. Kalesnik. "Timing 'Smart Beta' Strategies? Of Course!" Research Affiliates, 2016.

Asness, C., S. Chandra, A. Ilmanen, and R. Israel. "Contrarian Factor Timing Is Deceptively Difficult." *The Journal of Portfolio Management*, Special Issue (2017), pp. 72-87.

Baltas, Nick. "The Impact of Crowing in Systematic ARP Investing." Goldman Sachs STS Insights, Issue 1 (2018).

Bender, J., X. Sun, R. Thomas, and V. Zdorovtsov. "The Promises and Pitfalls of Factor Timing." *The Journal of Portfolio Management*, Quantitative Special Issue (2018), pp. 79-92.

Cahan, R. and Y. Luo. "Standing Out From the Crowd: *Measuring Crowding in Quantitative Strategies*." *The Journal of Portfolio Management*, Summer (2013), pp. 14-23.

Carhart, M., U. Cheah, G. De Santis, H. Farrell, and R. Litterman. "Exotic Beta Revisited." *Financial Analysts Journal*, Vol. 70, No. 5 (September / October 2014), pp. 24-52.

Hodges, P., K. Hogan, J. R. Peterson, and A. Ang. "Factor Timing with Cross-Sectional and Time Series Predictors." *The Journal of Portfolio Management*, Fall (2017), pp. 30-43.

Kahn, R. N., and M. Lemmon. "Smart Beta: *The Owner's Manual*." *The Journal of Portfolio Management*, Winter (2015), pp. 76-83.

Khandani, A. and A. Lo. "What Happened to the Quants in August 2007?" http://web.mit.edu/Alo/www/Papers/august07.pdf . MIT working paper, 2007.

Konstantinov, G.. "Currency Crowdedness Generated by Global Bond Funds." *The Journal of Portfolio Management*, Winter (2017), pp. 123-135.

Kuenzi, D. E. "Shedding Light on Alternative Beta: A Volatility and Fixed Income Asset Class Comparison." *Volatility as an Asset Class*, Ed. Izzy Nelken, Risk Books, London, 2007, pp. 61-82.

Lo, A. "The Statistics of Sharpe Ratios." *Financial Analysts Journal*, Vol. 58, No. 4 (July / August 2002), pp. 36-52.

——. "The Adaptive Markets Hypothesis." *The Journal of Portfolio Management*, 30th Anniversary Issue (2004), pp. 15-29.

——. "Adaptive Markets and the New World Order." *Financial Analysts Journal*, Vol. 68, No. 2 (March / April 2012), pp. 18-29.

——. "What is an Index?" https://papers.ssrn.com/sol3/Papers.cfm?abstract_id=2672755. MIT working paper, (2015).

McLean, D. R. and J. Pontiff. "Does Academic Research Destroy Stock Return Predictability?" Working Paper, https://www2.bc.edu/jeffrey-pontiff/Documents/Predictability%20JF%20with%20copy%20edits%20Final.pdf (May 16, 2013).

Miller, K. L., H. Li, T. G. Zhou, and D. Giamouridis. "A Risk-Oriented Model for Factor Timing Decisions." *The Journal of Portfolio Management*, Spring (2015), pp. 46-58.

Pojarliev, M. and R. M. Levich. "Detecting Crowded Trades in Currency Funds." *Financial Analysts Journal*, Vol. 67, No. 1 (January / February 2011), pp. 26-39.

Sabar, R. "A Methodical Approach to Retiring Strategies." https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2660984 . Ellington Management Group working paper, 2015.