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# CRO<sup>®</sup> Class Framework

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## Introduction

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### Public Defined Benefit Pension Plan Challenges

Over the last 20-plus years, the majority of defined benefit pension plans have experienced drastic changes. Between experiencing two bear markets and failing to receive the necessary contributions on multiple occasions, the average U.S. public defined benefit pension plan is materially underfunded. Further compounding this challenge, higher retiree-to-active ratios have placed significant cash-flow stress on the defined benefit pension plan model. The combination of being underfunded and possessing negative net cash-flow leaves a sizable proportion of U.S. public defined benefit pension plans in highly precarious positions. Moreover, in the current market environment, where risk-oriented assets are priced to perfection, the potential headwind for plan longevity is even greater.

### Plan Sustainability is at Risk

The worst scenario that a defined benefit pension plan can experience is a material market drawdown that affects the majority of an investment portfolio right when the plan sponsor's contribution schedule is also impaired, forcing assets to be sold to fulfill benefit requirements. While PCA is not predicting this scenario will occur anytime in the near future, it certainly has a non-zero probability.

### The Crisis Risk Offset (CRO®) Class Can Help Offset Drawdowns

In order to help protect against such a potentially challenging scenario, PCA has created the CRO® Class. At a high-level, this class is designed to have a high probability of appreciating significantly during material market drawdowns while also generating a positive return over the long-term. In other words, the CRO® Class is designed to provide diversification that actually works and is impactful. The following sections describe the characteristics, components, and risks of such a class. Additionally, a subsequent write-up will describe what certain PCA clients have experienced during the initial implementations of such classes.

## Class Overview

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A Crisis Risk Offset (CRO®) Class is designed to provide impactful diversification relative to a plan's *Growth-risk* exposed assets (i.e., assets susceptible to changes in global economic growth and/or corporate profitability). On a holistic basis, an ideal version of the class will possess the following attributes:

- Implemented in deep and liquid markets
- Capital efficient components (i.e., high volatility strategies)
- Short- and long-term volatility levels that are similar to a corresponding liquid *Growth-risk* portfolio
- De minimis strategic exposure to *Growth-risk* related assets
- Emphasis on beta/risk premia-oriented strategies and systematic implementations
- Positive standalone return-to-risk expectations throughout the underlying components
- Low or negative conditional correlation to public equity
- Low cost

The benefits of a Crisis Risk Offset Class (i.e., impactful diversification) are most pronounced in material, prolonged drawdowns of *Growth-risk* exposed assets. During shorter periods of financial market stress (e.g., equity market corrections), the results of a CRO® Class will likely vary (i.e., may be an offset or may coincide). This attribute of short-term unreliability is one of the main hurdles with respect to understanding the class and gauging its corresponding level of success. With that said, however, this attribute is also somewhat of a necessity in order for the class to maintain a positive standalone return-to-risk. The components within a CRO® Class are risky in and of themselves (i.e., they are volatile and will experience material drawdowns), but they are constructed to exhibit different behavior (on average) than *Growth-risk* exposed assets. At its core, a CRO® Class is based on one of the primary rules of portfolio management – diversification works.

In order for a CRO® Class to have a noticeable impact on a total portfolio, it generally requires an allocation of 10% or more, as evident from several large-scale asset-liability studies conducted in recent years. Generically speaking, allocations near 20% tend to exhibit the most optimal short- and long-term results for many plan sponsors.

## Class Components

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PCA considers the following components appropriate for a CRO® Class. These components and their corresponding descriptions are listed in order of importance with respect to the design of such a class. In PCA's opinion, a CRO® Class should, at a minimum, consist of components #1 and #2, with a more optimal configuration also including component #3. For clients that view component #4 to be attractive, this may also be included to potentially further enhance the class.

### 1) Long U.S. Treasury Duration

- Interest Rate Risk (i.e., duration) is an effective diversifier during most material drawdowns in *Growth-risk* exposed assets.
- The majority of material drawdowns in *Growth-risk* exposed assets are deflationary in nature, and this increases the attractiveness of fixed coupon payments, ultimately resulting in higher bond prices.
- Due to the general acceptance of U.S. Treasury bills/notes/bonds as being default-free, these instruments typically receive the greatest price increases.
- In addition to the deflationary factor, U.S. Treasury securities historically have also benefited from the U.S. Dollar's perceived superiority amongst global currencies. As investors sell other currencies to buy U.S. Dollars during material market drawdowns, this can further reinforce lower interest rates (and thus higher U.S. Treasury prices).
- Moreover, the Federal Reserve often loosens monetary policy in order to combat economic crises, providing further support to the price of U.S. Treasury securities.
- U.S. Treasury securities can be considered the "first responder" during most material drawdowns in *Growth-risk* exposed assets.
- Seeing as the long-end of the yield curve is primarily driven by inflation and economic growth factors, this further bolsters the predictability of long U.S. Treasury bonds reacting positively during a deflationary economic drawdown.
- To be impactful, however, this component needs to have a duration of 15+ years. Long U.S. Treasury bonds, STRIPs, and/or U.S. Treasury futures can potentially fulfill this objective.
- Potential indices/proxies are the Bloomberg Barclays Long U.S. Government Index and Bloomberg Barclays Long U.S. Treasury Index.
- Passive or enhanced index strategy management are PCA's preferred implementations.
- Implementations should generally be in the 1-5 basis point range (management fees).

### 2) Systematic Trend Following

- Trend Following is based on the concept of *Momentum* – that which has done well recently will continue to do well and that which has done poorly recently will continue to do poorly. In particular, Trend Following is focused on time series momentum (i.e., returns of an asset relative to itself).
- "Systematic" refers to following a set of pre-defined rules for the implementation as opposed to discretionary management.
- Related terms include "managed futures" and "commodity trading advisors" (or "CTAs").
- These strategies typically invest across the four major public asset classes (public equity, fixed income, commodities, and currencies) with a focus on indices and/or higher-level

- bases (e.g., U.S. 10-Year Treasury Rate). Positions may be long or short across any of these assets.
- Ultimately, Trend Following results in a volatile, yet lowly correlated strategy when compared to *Growth-risk* exposed assets. This often manifests itself in a positive correlation during bull markets and a negative correlation during bear markets (i.e., a correlation “smile”). Moreover, these strategies are often characterized by convex payoffs that include a large amount of small losses and a small amount of large gains.
  - Underlying reasons for the efficacy of such strategies include:
    - 1) Behavioral Factors
      - i. Underreaction
        - a. When news/economic events are announced, market participants do not extrapolate the full impacts. Rather than “jumping” to the proper price, a security’s value changes more slowly than expected (and thus “trends”).
      - ii. Feedback Loops
        - a. Investors often follow recent returns and/or news and compound the effects.
      - iii. Herding
        - a. Similar to the idea of feedback loops but more specific to investors that follow/copy other investors.
    - 2) Economic Factors
      - i. Price Risk
        - a. In commodity and currency markets, companies often hedge their sales, purchases, and exposures via derivatives. Investors who are on the other sides of these trades require a premium/payment to bear the price risk of the underlying asset.
    - 3) Combination of Economic and Behavioral Factors
      - i. Market Regimes
        - a. As markets shift from one regime to another, prices recalibrate to the new regime. As this occurs, prices tend to trend in the direction rather than jump.
      - ii. Time Varying Risk Premia
        - a. As risk premiums change, security prices may trend in corresponding directions.
  - Ideal versions of Trend Following utilize straight-forward rules with appropriate risk management techniques (e.g., risk balanced across asset categories).
  - Strategies should generally target annualized volatilities in the range of 15%-20% over a full market cycle; however, there are several ways of achieving such targets:
    - 1) Daily Volatility Targeting
      - i. This methodology generally aims for a specific volatility target on a daily basis and modifies the portfolio accordingly irrespective of the strength of trends and/or the broader market environment.
      - ii. Leverage/notional levels can widely vary.
    - 2) Volatility Targeting Range
      - i. This methodology targets a range (e.g., 10%-30%) with the target volatility on any given day generally based on the strength of underlying trends and/or the broader market environment.
      - ii. Leverage/notional levels can widely vary.
    - 3) Constant Notional Level
      - i. This methodology is based on the concept of letting the aggregate capital markets determine the portfolio volatility. By always investing a specific notional amount (e.g., 3.5x of equity), the portfolio inherently adapts to the dynamics of the broader capital markets. The notional

target is typically calibrated over a long-run history in order to average an approximate target in the 15%-20% range.

- All three methods of volatility targeting are appropriate to utilize; however, PCA's preference is for methods #2 and/or #3 because they are typically more impactful to the success of a CRO® Class.
- PCA prefers strategies that are biased towards medium- and longer-term trends. While short-term Trend Following has the advantage of reacting more quickly to market events, this benefit is often nullified by whipsaws and increased transaction costs. Empirically, medium- to long-term Trend Following has provided the most robust levels of diversification and portfolio benefits.
- These strategies can often be considered the secondary responder as they adapt and position themselves for the second phases of material drawdowns. Unfortunately, however, their positioning during the first leg of a drawdown is unreliable and may be correct or incorrect depending on the specific event.
- Currently, the most relevant indices include those from Mount Lucas Management and Credit Suisse. The Mount Lucas Management indices target specific notional amounts that are based on long-term volatility targets, whereas the Credit Suisse indices target specific (e.g., 12%, 15%, 18%, and 20%) volatility levels on a shorter-term basis.
- Implementations should generally be in the range of 20 basis points (replication) to 70 basis points (more sophisticated strategies) inclusive of fund operating costs (if applicable).
- PCA does not believe that performance-based fee schedules should be utilized.

### 3) Alternative Risk Premia

- These strategies seek to harvest risk premia that are different than (i.e., alternative to) traditional risk premia (e.g., equity risk and interest rate risk).
- The most common Alternative Risk Premia are *Value*, *Carry*, and *Momentum*.
- Although Trend Following is often included in Alternative Risk Premia strategies as time series momentum, PCA's preference is to only include cross-sectional momentum due to its market-neutral characteristic. Additionally, Trend Following strategies are far cheaper to access than Alternative Risk Premia strategies, and thus, in PCA's opinion, they should be managed in separate mandates. Moreover, plan sponsors can access more attractive Trend Following strategies (or create more robust Trend Following components) when they are incorporated via dedicated mandates.
- Optimal Alternative Risk Premia strategies tend to exhibit the following characteristics:
  - i. Multi-asset portfolios
  - ii. Multi-premia implementations
  - iii. Near market-neutral exposures
  - iv. A focus on the most researched/well-documented premia
  - v. Reasonable/lower amount of parameters in factor/portfolio construction
  - vi. Exposure to risk premia that a client does not already have
  - vii. General avoidance of premia that can conditionally behave like public equities
- Alternative Risk Premia can be harvested at both the macro level (i.e., indices) and micro-level (i.e., single name securities). PCA prefers that managers include both as this further increases the breadth of the strategies. Unfortunately, however, a large amount of the new entrants into this market segment tend to focus solely on the macro level. The one benefit of these approaches is their ability to obtain higher volatility levels than their more diversified competitors.
- Volatility targets should be at least 10%; however, only a portion of the manager universe will target anything higher than 12% unless their implementations are focused only on a handful of macro level premia across a smaller universe of assets. Similar to Systematic Trend Following, these volatility levels are achieved via forms of leverage.

- Due to the dynamic relationships that these premia have with *Growth-risk* exposed assets (i.e., a relationship that is not accurately described by a single correlation statistic), it is difficult to gain a reliable estimate of their behavior during market drawdown periods. Their reliability can be marginally improved, however, by seeking strategies that are focused on the diversification properties of the strategy as opposed to the Sharpe Ratio attribute. Unfortunately, considering that a large portion of institutional investors have begun allocating to Alternative Risk Premia strategies as a form of hedge fund replacement, coupled with the fact that many of the managers in the segment have histories/experience managing hedge funds, in PCA's opinion, the majority of the products in this market segment are overly focused on their Sharpe Ratios. This often decreases their diversification characteristics and/or results in Trend Following being included.
- Alternative Risk Premia strategies are included in a CRO® Class for the primary reason of moderately bolstering the class return during normal times with a secondary reason of adding additional diversification properties to the class. Despite this hierarchy, PCA's preference is to focus on the diversification characteristics. This hierarchy exists in this form only due to the inconsistent reliability of the diversification characteristics.
- At this time, there is not a consensus with respect to appropriate indices for performance comparisons and/or replication implementations. PCA currently recommends that clients utilize a long-term benchmark of CPI+2-3% for these strategies. Moreover, PCA is currently working with various benchmark providers and research firms to analyze the index landscape that currently exists (largely bank-related indices/products) with the goal of creating a useful benchmark for the market segment.
- Implementations should be under the 100 basis points mark inclusive of fund operating costs (if applicable).
- PCA does not believe that performance-based fee schedules should be utilized.

#### 4) Tail-Risk Protection

- Tail-Risk Protection is most commonly implemented via derivatives and, in particular, via long volatility positions (e.g., long equity-oriented put options).
- The primary benefits of these strategies are their near-guaranteed protection and highly convex payoffs (i.e., increasingly positive returns during market drawdowns). These benefits can be nullified over longer-term periods, however, due to the negative carry (i.e., negative expected return) and management costs.
- The convex payoff associated with these strategies can often result in a 100%+ return during a material (e.g., >30%) equity market decline.
- To the extent that it is possible, strategies that can minimize the negative carry costs and/or provide increased amounts of convex payoffs may potentially find a spot in a CRO® Class.
- These strategies are extremely difficult to model and develop risk/return expectations for, which results in an additional hurdle for their inclusion in a CRO® Class.
- PCA is currently conducting research to determine potential allocations to Tail-Risk protection strategies within CRO® Classes.

## **Class Risks**

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A CRO® Class has several key attributes that directly relate to significant risks:

- 1) Both the aggregate class and underlying components are volatile by design.
  - With any meaningful volatility comes the potential for material drawdowns. Considering each of the components generate 10-20% annualized volatilities with a generic aggregate class exhibiting a volatility near 10%, one should expect an aggregate class to experience drawdowns of 15% or more at some point in a full market cycle, with

certain underlying components experiencing even greater drawdowns. To err on the side of caution, we believe a general rule of thumb is that a CRO® Class should be expected to draw down by a similar amount as public equities do but at different times (i.e., diversification). Related to this notion is the fact that various underlying components rely on forms of leverage to achieve their volatility targets.

- 2) The class has a positive expected return-to-risk.
  - A basic underpinning of economic theory is that investment returns are driven by bearing risks (i.e., if one were to expect a return for not bearing a risk, that would be considered an arbitrage opportunity). A CRO® Class is no different in that it has a positive expected return (e.g., 1-3% real return), implying that the class and (most) of its components are exposed to certain economic risks. The key element with this notion is that these risks are typically different than *Growth-risk*, thus providing diversification relative to the primary risk in standard institutional investment portfolios.
- 3) The behavior during smaller drawdown periods is highly unpredictable.
  - One could describe a CRO® Class as being conditionally negatively correlated to *Growth-risk* assets during material market drawdowns (>20%) while being uncorrelated during most other periods. What this means is that during significant drawdowns, a properly designed CRO® Class should be expected to appreciate, whereas during other periods, the relationship is essentially random (i.e., it may move with or opposite *Growth-risk* assets). This is a key feature that allows a CRO® Class to work. If a given class protected against all market drawdown (small or large), that would be called insurance and would require a negative expected return-to-risk and a corresponding large drag on total portfolio returns over time.
- 4) Risk premiums are the primary source of the class's behavior.
  - Like any risk premium, the risk premiums that are within a CRO® Class (i.e., interest rate risk, time series momentum, market-neutral alternative risk premiums, etc.) will be in favor and out of favor at times. This is contrary to the allure of "alpha" in which is continually touted as being all-weather or absolute return. As such, just like more traditional classes, one should expect negative returns from a CRO® Class during certain market environments, but the goal is that these drawdowns occur at different times than those of *Growth-risk* exposed assets.
- 5) It is not infallible.
  - The design of a CRO® Class is based on empirical and academic research and further supported by economic intuition. Regardless, there are zero guarantees within the global capital markets and a CRO® Class is no exception. There is the potential for a material drawdown in a CRO® Class to occur at the same time as *Growth-risk* exposed assets, but this commonality has hopefully been minimized in the class's construction. Additionally, adopting a CRO® Class requires investors be willing to look different than peer funds in many cases. This will likely manifest itself via lagging peers during strong bull markets and (potentially) outperforming peers during material bear markets.

## Class Construction

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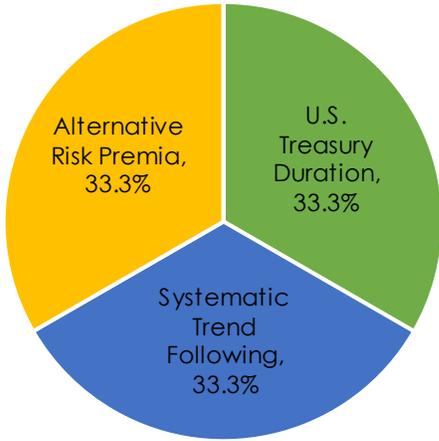
A key facet of a CRO® Class is that its efficacy is not overly reliant upon its construction (i.e., component weights). As long as the component weights are not at the extremes (i.e., not too large nor too small), one should have similar confidence levels about the reliability of multiple CRO® Class configurations. While a modest amount of optimization can be worthwhile, incorporating a heavy dose of humility is also prudent when constructing a CRO® Class. As a result, PCA typically recommends that clients utilize

an approximate balanced approach (either via equal capital or equal risk weights) for the first three potential components (with a bias towards U.S. Treasury Duration and/or Systematic Trend Following). If the fourth component (i.e., Tail-Risk Protection) is incorporated, PCA would likely recommend its inclusion be at a materially smaller weight (e.g., 10%).

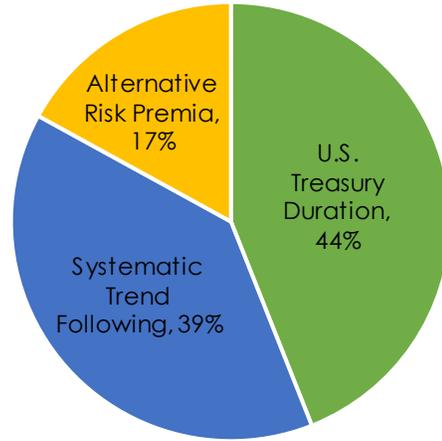
Sample allocations are included on the following page, but specific implementations should be designed through modest optimization exercises.

**Example #1: Equal Capital Weights (Core Components)**

**Capital Weights**

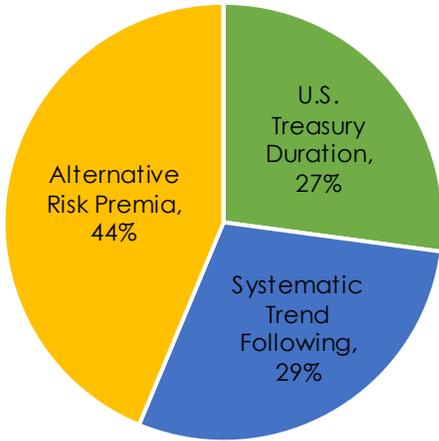


**Approximate Long-term Risk Weights**

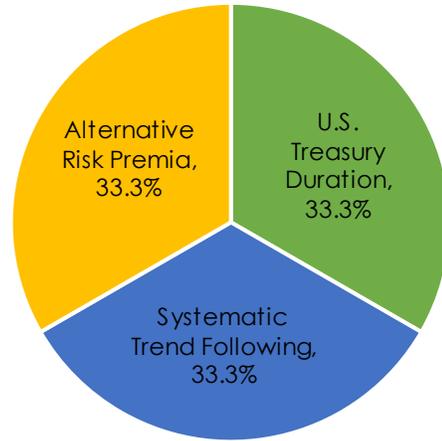


**Example #2: Equal Risk Weights (Core Components)**

**Capital Weights**

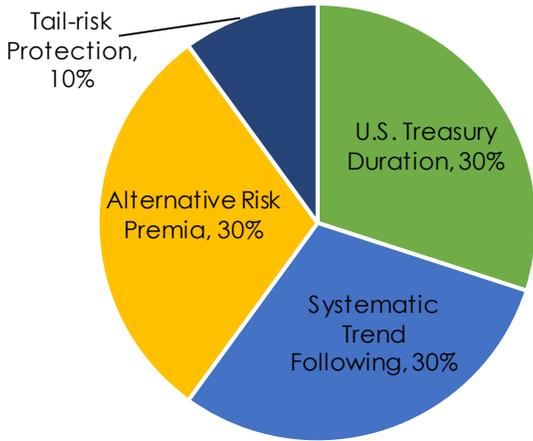


**Approximate Long-term Risk Weights**

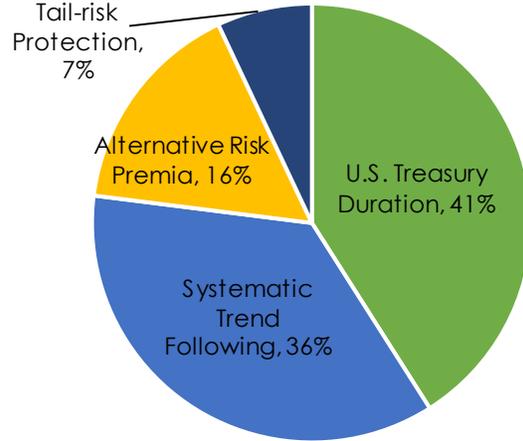


**Example #3: All Four Components\***

**Capital Weights**



**Approximate Long-term Risk Weights**



\*Due to the highly convex and non-normal distribution of returns, Tail-Risk protection is extremely difficult to model

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