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A Primer on Factor Investing

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A PRIMER ON FACTOR INVESTING

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ABSTRACT: While factors have become the foundation of investing, it is increasingly difficult to observe these factors. With a nascent market like crypto, it becomes imperative that we identify and successfully extract targeted factors driving our asset returns. In this article, we come up with a Three Risk Factor Framework, which involves identification: based on economic justification, observable and resistant return patterns, longevity, robustness, and cost-effective implementation. This is followed by a Rationale framework by which asset returns are driven by systematic risk that reflect compensations for providing insurance, exploit market inefficiencies due to persistent investor behavior biases and accommodate structural market imbalances. Lastly, we have a factor extraction framework which includes idiosyncratic factors, macro factors and statistical factors.

INTRODUCTION

Factor investing aims to capture *known*, *persistent*, and *large enough* risk premia associated with **systematic market inefficiencies** (Behavioral Finance explanation) or **systematic sources of risk** (Efficient Market Hypothesis explanation). In simple terms, factors decompose the Beta and leave the Alpha as the only unexplained source of excessive returns, attributable thus to the skill of the Portfolio Manager.

Risk Premia *are also known as discount rates or expected returns, see Cochrane (2011) for an insightful exploration on this topic: "All of these theories and related facts are really about discount rates, expected returns, risk-bearing, risk sharing, and risk premiums."*

It all started with the **Capital Asset Pricing Model** (CAPM), drafted by Treynor in 1961 in an unpublished manuscript. CAPM has been the first theory of factor risks. Later, a multi-factor model has been introduced in the **Arbitrage Pricing Theory** by Ross (1976). As an evolution of this, Risk Factors seen as investment styles have been proposed by **Sharpe** in 1978 and later refined by him in 1988 and 1992. Throughout the years, this

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topic attracted considerable academic literature, bringing eventually the two of its most known advocates, **Fama and French**, to a Nobel Prize for their 1993 work on a three-factor model. For the past 30 years the literature around Risk Factors hasn't slowed down, but we will not review it here, as it's out of scope for this article.

THREE RISK FACTOR FRAMEWORKS

As the literature on Risk Factors is so vast, we want to **synthesize a framework** to help us define what are these factors. Factors are generally *unobservable* and thus their definitions are subject to debate and success lies in **identifying** and **systematically harvesting**, i.e. extracting, a targeted factor. Even when we are able to extract factors, it doesn't mean we will always receive a risk premium. A certain factor is linked to the underlying risk characteristic, but it can be rewarded for its own fluctuation, rather than for a certain risk. Indeed, historically, *fluctuations in risk premia* have been even more important than their level (refer to the factor-rotation literature). On this same point, Ibbotson et al. (2012) explain the premia for certain styles as a "payoff for taking on a characteristic that the market considers *undesirable*", but not necessarily *riskier*. For example, think of low-volatility portfolios: sometimes Portfolio Managers prefer more stable returns, while others like the upside potential with higher volatility assets.

RISK FACTOR IDENTIFICATION FRAMEWORK

Ang et al. (2009) outline several criteria for determining what should be a factor, and here we expand on them with our Risk Factor *identification* framework:

1. **Economic or academic justification (i.e., a sensible basis):** compelling and rational logic or widely recognized behavioral stories. Here, unanimity on the mechanisms generating a certain risk premium is not required. New research can identify new factors and qualify or disqualify already known factors. Optimization techniques used, for instance, in Smart Beta (one of the names given to investable factor indices) usually fail to qualify in this category, given that they are

based on the decomposition of covariance matrices of returns and not on economic rationale.

2. **Observable and expected to persist return patterns:** Risk Factors are *not investment strategies per se, they thus shouldn't be diversified away* with the growing number of adopters. Factor investing is not about the exploitation of anomalies (which is in the Alpha domain) but is just an alternative way of getting exposure to different risks. Factor risk premia will disappear only if the economy totally changes, i.e. there is a regime change.

3. **Long-term:** there is a *full cycle of factor performance data*, with a timeframe long enough to avoid data mining issues. *All premia are time-variant and this variation should be known and taken into account*. When this is not the case, Factor modelling requires considerable effort to continuously validate and monitor the models, as well as to bootstrap longer time series through more advanced data modelling techniques.

4. **Cost-effective implementation:** Risk Factors should be implementable in liquid and tradable securities. These factors should also be scalable. The trading costs of these "anomalies" should be lower than the returns a certain factor adds to the portfolio performance.

5. **Pervasive and robust:** factors should be available in different markets, geographies, and for different asset classes. This latter is the most recent research direction with cross-asset Factor Investing. See, for instance, "Value and Momentum Everywhere" by Asness et al. (2013) or, more recently, Baltussen et al. (2021).

RISK FACTOR RATIONALE FRAMEWORK

As mentioned earlier, factors are generally *unobservable*, so we also need a framework that helps us explain the existence of these premia. At Cloudwall we tackle this with our Risk Factor *rationale* framework. According to this framework, asset returns are driven by *systematic sources of risk* that 1) reflect compensations for *providing insurance* (risk

transfer), 2) are exploiting *persistent behavioral biases*, or 3) are accommodating *structural market imbalances*. In particular:

1. **Rational (risk transfer):** factor risk premia are due to systematic sources of risk and we are thus being paid to withstand negative returns when that risk materializes. The decision whether to invest or not is thus based on the willingness of investors to take these risks, as well as their appropriateness. These risks will not go away until a radical change in the economic regime (for instance, at the level of the investor or consumer preferences). We see this rational explanation as due to the risk transfer from investors able to withstand "bad times" and cultivate risk premia offered to investors looking for insurance.
2. **Behavioural:** factor risk premia are due to *systematic market inefficiencies*, with investors over-or under-reacting to events. Here the risk is not the fact that once in a while we will see a very negative performance, but the persistence of a certain behavioural bias.
3. **Structural:** factor risk premia could be due, for instance, to market segmentation, with a certain type of investors constrained in their allocation decisions. Cochrane (2011) calls it "limited risk-bearing ability. Think about the inability of certain institutional investors to allocate to small-cap stocks because it would not be economical to do so.

The three explanations are *not mutually exclusive*, with the possibility to apply all or pairs of them to a single factor premium. Note that in Crypto it's very likely that the Rational and the Behavioral explanations still hold, while the Structural considerations might be different, especially if they refer to technological constraints.

Despite different possible explanations, the decision rule on the premia to collect should not be based on whether we believe in the Behavioral Finance or the Efficient Market Hypothesis explanation, but on whether and by how much the investor using that factor deviates from the average person subject to that rational, behavioral or structural constraint.

If you want to learn more about another risk premia identification framework, read the full Cochrane (2011) paper (or watch him present that work), especially if you are more into the Economics- or friction-based explanations. That paper is just outstanding.

RISK FACTOR EXTRACTION FRAMEWORK

Finally, we need a Risk Factor extraction framework to help us with the systematic harvesting of risk premia.

1. **Idiosyncratic factors:** built on cross-sectional characteristics of specific assets (fundamental or price-based), used as proxies for unobserved factors.
2. **Macro factors:** based on macroeconomic variables, but also on features such as other markets, instruments, or their combinations.
3. **Statistical factors:** extracted through methods such as PCA, signal-processing, clustering, and so on, i.e. mostly a black-box methodology that loses to the previous two in explainability.

All of these have their advantages, as well as their drawbacks. Macro factors are economically meaningful, though their impact is mostly long-term and the causality is usually hard to define. Idiosyncratic factors are definable and their sensitivities measurable, though they are unobservable (they have to be estimated or derived in a "strategy form"). Statistical factors are defined and their sensitivities are measurable, though it is usually difficult to understand their economic rationale and the stationarity assumptions are usually unrealistic (check some insights in our piece on the PCA analysis of cryptocurrencies). If you want some food for thought, think about why this Extraction framework is different between TradFi and Crypto. The answer should be in the differences in the type, amount, and quality of the data.

The above three frameworks together can be used to give risk premia a sound theoretic rationale and in defining our digital asset risk premia we will follow these frameworks.

MAIN RISK FACTORS

To conclude, we'll list the main Risk Factors studied in TradFi, and we'll leave it to our future posts to define the same for cryptocurrencies. Factors are generally unobservable and thus their definitions are subject to debate, though the most well-known factors are as follows (we'll cite either the first or the most influential paper studying the specific factor):

- **Value** (Basu, 1977): commonly captured by the excess returns on assets with a relatively low expected return with respect to fundamentals such as book value, earnings, sales, cash flows, etc.
- **Size** (Banz, 1981): captures excess returns of smaller firms relative to larger ones and seems to be mostly a liquidity premium (especially in Equities).
- **Market** (Fama and French, 1993): it's defined as the excess market return, i.e. market return minus the risk-free rate. Check out also Treynor's unpublished manuscript from 1961, a piece of history for quants.
- **Momentum** (Jegadeesh and Titman, 1993): excess returns due to stronger relative past performance. Momentum could refer to different asset classes, as well as to their characteristics (e.g. Earnings momentum).
- **Volatility** (Haugen and Baker, 1991): lower volatility stocks tend to deliver higher returns than riskier stocks, which could be due to investors preferring lotteries and viewing high volatility stocks as gambling tools (or leverage), inflating their price and thus depressing future returns. Related to crypto and how this connects to the Prospect Theory, check out my short note on a recent paper.
- **Quality** (Sloan, 1996): excess returns according to the Value Investing philosophy, based on company characteristics such as low debt, stable earnings, and other "quality" metrics.
- **Carry** (various): in general, taking advantage of the differences between higher-yielding assets and financing with those with a lower yield. The literature here is extensive, starting on the Commodities side with Working (1949) and Breeden (1980) for the carry cost as a risk premium, going through Frankel (1984) for the

supply-demand-inventories relationship or Fama and French (1987) research on the forecasting power of storage costs. Carry in FX is usually based on tests of the Uncovered Interest Rate Parity (UIP), initially tested by Geweke and Feige (1979) and Tryon (1979), with the first out-of-sample tests in Bilson (1981) and Meese and Rogoff (1983). We got carried away, let us get back on track…

All of these are multi-asset, so we should be able to see these risk premia also in crypto, and we'll call them crypto-specific. As an example, think about the Carry factor. In Equities, the carry is related to the dividend yield. In commodities, it is the relationship between interest rates, inventories, and spot-forward prices, creating phenomena like backwardation and contango. In FX we have the "Forward Premium Puzzle", i.e. the outperformance of investment currencies (with a higher interest rate) over the funding currencies (lower interest rates).

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