



## Prof. Fabio Trojani

Fabio Trojani is Professor of Statistics and Finance at the University of Geneva and holds an SFI Senior Chair. He obtained his PhD in Economics and Finance from the University of Zurich. His research interests are in asset pricing, and in the application of econometric and data science methods to finance.

## Factor Investing

Today's global investment landscape is made up of millions of securities, traded in hundreds of trading exchanges, and appearing in dozens of asset classes. Knowing what investors want to see in their portfolios and what will drive those portfolios' value up or down is by no means trivial. Such drivers, which can actually be captured by so-called factors, are at the very heart of today's investment models for factor investing. The financial industry separates factors into two broad categories: macro factors, such as economic growth, liquidity, or inflation, and style factors, such as value, momentum, or size. Being able to identify factors allows investors to build portfolios in a more transparent way, which helps them pursue their needs and objectives. Factors are usually only lowly correlated to one another and each may be related to the economic cycle in a different way. Therefore, factor investing may also need adjustments from time to time.

### Is factor investing a new form of investment?

The first model developed to describe the relationship between risk and financial returns was the capital asset pricing model, the CAPM. According to the CAPM, investors are compensated for the riskiness of their investments because of their exposures to a single risk factor, the whole market. All models have drawbacks and the CAPM has displayed a number of empirical weaknesses. Several models based on multiple risk factors were, therefore, subsequently developed. These models explain differences in returns across assets by their different exposures to multiple risk factors. Moreover, the recent literature has also incorporated settings where both factor risk premia and factor exposures are time varying. But because of computational limitations and missing theoretical foundations it was, until recently, not possible to estimate factor risk premia and factor exposures precisely. Recent advances in computational power and academic research have made it possible to exploit the information in large datasets of individual stock returns to produce precise estimates of time-varying risk premia and risk exposures.

### How has the increase in computational capacity changed the way investment decisions are made?

Earlier limitations in computational power made it necessary to compress the information existing in the whole universe of stock returns into a small set of factor replicating portfolios. This approach, however, tends to strongly reduce the precision of estimated factor exposures and factor risk premia. In contrast, recent advances have made it possible to exploit the information in large datasets of individual stock returns.

Results based on the returns of tens of thousands of US stocks during 45 years show that risk premia are both large and volatile during crisis periods. Moreover, time-varying risk premia follow macroeconomic cycles in a way that is consistent with economic intuition—with, for instance, smaller stocks having larger risk premia in phases of recession.

### How does factor investing perform with respect to naive 1/N investment strategies?

Although it is true that naive 1/N investment strategies have been shown to be surprisingly difficult to outperform, modern research shows that optimal factor portfolios estimated using the information from the whole universe of individual stocks do significantly outperform them, producing higher Sharpe ratios and certainty equivalents. Importantly, the turnover of modern factor strategies is lower and produces less transaction costs.

### What factors perform well in an international setting?

An analysis of a total of 58'674 stocks traded in one or more of 46 countries and over a 30-year period identifies the different risk factors that are at work in an international context. In developed markets, data show that country market premia are smaller than world or regional market premia and that diversification benefits are therefore limited. Results differ for emerging markets, where country factor risk premia are large relative to world or regional factor risk premia and in which investors can further benefit from diversification. Furthermore, the estimated factor risk premia of international stocks change over time. For example, value and momentum premia show more variability than profitability and investment.

### Where does the future of factor investment research stand?

The abundance of empirical research carried out has brought with it a new and important challenge, as now hundreds of risk factors have been found to impact asset prices and returns. These factors are typically constructed as long-short portfolios of stock ranked with respect to a particular characteristic, such as size, volatility, liquidity, etc. New methods based on machine learning techniques are able to efficiently extract the optimal combination of stock characteristics for predicting the individual stock returns. In this context, approaches allowing for nonlinearities and complex interactions between stocks provide Sharpe ratios that are three times larger than those based on linear models.



## Christophe Donay

Christophe Donay joined Banque Pictet & Cie SA in 2008 as chief strategist of the Wealth Management branch. Prior to that, he worked at INSEAD, BNP Paribas, and Kepler Chevreux (formerly Julius Baer Brokerage). Donay holds Master's degrees in Economics and in Econometrics from the Universities of Paris X and Paris II. Equity Partner, Head of Asset Allocation and Macroeconomic Research, Executive member of the Wealth Management Investment Committee, Member of the Investment Board, Chairman of the Investment Strategy Committee of the Pictet Pension Fund.

## Regime-Based and Risk Factor-Based Asset Allocation

Predicting the returns for different asset classes is the Holy Grail of asset allocation. The problem is that risk premiums and returns are instable over time. According to our analysis, over the long term (our data stretches back 115 years) there is a 90 percent probability of achieving an annual average return of 8 percent with a 60/40 portfolio. But that probability declines sharply as the time span shortens. Once the standard deviation reaches a certain point, one could argue that to speak of an "average" is meaningless and that investment success over a reasonable time horizon becomes a matter of luck. By the same token, one could argue that any bid to measure a "standard" risk premium for the purposes of long-term investing is just as meaningless.

But starting from the fact that the investment environment alters over time, we believe that reasoning in terms of macroeconomic "regime" can help determine an appropriate strategic asset allocation. This regime approach posits that a strategic asset allocation requires deep analysis of the macroeconomic issues driving market returns that goes beyond one centered on traditional risk premium factors. The probability of achieving higher returns is reduced if one adopts a stable view of risk premiums: these higher returns, we believe, are more likely if one accepts that risk premiums vary across regimes.

Accepting that changes in the macroeconomic environment are the true drivers of variations in risk premium has been part of the resurgence in a risk factor-based approach to asset pricing and is now an intrinsic part of strategic asset allocation. Understanding what economic regime we are in and for how long before we transition to a different one is vital for any strategic asset allocator.

We believe that the essential macro risk factors are real economic growth and inflation. The 10 years between 2007 and 2016, in the US, can be characterized as a "low growth and low inflation" regime, for example, with both measures struggling to exceed 2 percent. Our present strategic asset allocation is including the possibility that we are currently moving into a new regime.

An illustration of varying risk premiums as a function of macroeconomic regimes can be identified through asset return analysis. For example, since 1950, the S&P500 returned on average 5.6% annually in a low growth and low inflation regime, but 12.1% in a high growth and high inflation regime, with these regimes occurring 4% and 10% of the time. In the regime that prevailed the most often—that is to say, the moderate growth and moderate inflation regime, which occurred 39% of the time—the S&P500 returned 15.6% on average annually.

Inflation and growth vary over time, so ability to spot shifts in trends is fundamental in strategic asset allocation. The next step is to take account of a large range of factors in order to develop a view of a potential change in macroeconomic regime.

Using growth and inflation data stretching back to the end of World War II, we at Pictet Wealth Management have developed a methodology that identifies nine main economic regimes resulting from the interaction of three different phases of inflation and three types of growth. Regime shifts occur when the interaction between inflation and growth changes—with varying degrees of probability. We keep in mind that abrupt changes from one regime to another (say, from a regime of sluggish growth and disinflation to an innovation shock that produces high inflation) are highly improbable. But we believe our methodology is pertinent over typical strategic asset allocation horizons.

We do admit that more in-depth research is needed in this area. Using the Markov-switching model, for example, we can identify nine overarching changes in the economic environment in the US since 1950—but the importance the Markov model assigns to some highly improbable scenarios limits its usefulness in mapping out regime "shifts" according to our criteria. Nonetheless, our research indicates that the rebalancing of equity weightings within a regime-based portfolio to take account of shifts in the inflation and growth regime could help boost returns over a typical long-term investment horizon.

