

VIEWPOINTS

A Charles River Conversation

How Factor Models Inform the Investment Process

DIFFERENTIATING RISK AND RETURN DRIVERS



A State Street Company



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FACTOR MODELS ARE CHANGING THE WAY INSTITUTIONAL

investment managers construct portfolios and analyze portfolio risk. Many firms have turned to a factor-based approach because it removes the artificial constraints of asset class definitions, helping managers focus on risk drivers across their entire portfolio. This increases flexibility when making de-risking and hedging choices. By constructing portfolios based on risk factors instead of asset classes, managers can potentially build more efficient portfolios that require less risk to achieve competitive returns.

Charles River spoke with Katya Taycher, Managing Director at Charles River, and Dan diBartolomeo, President of Northfield Information Services to explore the multiple roles factor models play in the buy-side investment process.



KATYA TAYCHER

Managing Director, Charles River Development

Katya leads the product development for Portfolio Risk & Analytics at Charles River. Katya has over 20 years of experience on the buy side of financial services, specializing in financial risk and analytics. Prior to joining Charles River, Katya served in various product manager roles at Wellington Management, Evare, NerveWire, Merrill Lynch, and D.E. Shaw. Katya is a certified Financial Risk Manager (FRM), and

KT holds an MBA in Finance from The Wharton School at the University of Pennsylvania.



DAN DIBARTOLOMEO

President, Northfield Information Services

Dan diBartolomeo founded Northfield Information Services, Inc. in 1985 and serves as its President. Before starting Northfield, Mr. diBartolomeo served as Director of Research of a New York-based investment firm, where he was responsible for investment strategy and equity, fixed-income, and derivatives research. Dan serves on the Board of Directors of the Chicago Quantitative Alliance and the advisory board of the International Association of Financial Engineers.

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What are factor models, and why have they become an important tool in the buy-side investment process?

DD Factor models describe cause and effect relationships in financial markets that impact more than one security at a time. We understand that investors' preference for owning large-cap vs. small-cap stocks may be impacted by any number of factors including rising energy costs, interest rate changes, or lack of investor confidence in the markets. Factor models identify the key drivers of investor behavior and events in the financial markets over time. In particular, factor models can show whether investor behavior or market events will have a greater effect in the long run. There are causes behind structural events and factor models help illuminate them.

Factor models can help managers evaluate risk by market capitalization, style, momentum, or dividend yield. Once a manager has determined exposures at the portfolio level, the potential to accurately gauge overall portfolio risk is higher.

How are investment firms using factor exposures to construct more robust portfolios?

KT Any given security can have exposures to multiple risk factors but managers often do not take all these factors into consideration. For example, investors have traditionally used sector allocation or currency hedging to manage portfolio risk. The portfolio manager might want 30% of the portfolio allocated to the technology sector. However, that percentage does not include geographical risk. 20% of that allocation could be in US technology stocks and there are risks inherent in that underlying factor. Using factor exposures, however, provides a more accurate view of portfolio risk.

Let's use a US large-cap value technology stock as an example. How do factor models help managers evaluate the different risk exposures? First, factor models measure the amount of exposure each security has to the given risk factors. In the technology stock example, you might have a 10% exposure to value and 20% exposure to size or market capitalization. Then, you can determine the risk exposures to these factors across the portfolio.

Factor models can help managers evaluate risk by market capitalization, style, momentum, or dividend yield. Once a manager has determined exposures at the portfolio level, the potential to accurately gauge overall portfolio risk is higher. This enables the manager to better determine how to allocate portfolio assets by sector or security and match the risk of the portfolio to stated portfolio guidelines and philosophy.

Traditionally, portfolio managers viewed risk relative to a benchmark to identify active risk. How do factor models add to that view in helping managers understand the risks impacting their portfolios?

DD Managers can outperform or underperform their chosen benchmark through intentional choices made during the investment process and also through unintentional choices or outcomes. For example, I may invest in companies that I believe are well-managed or have a good product, but I may not have considered how they might be impacted by macroeconomic changes such as inflation or interest rates. Factor models can provide insight into what we already understand about the portfolio but also what we have not considered, which could have a highly negative impact on performance.

Let's pivot to volatility—how is volatility used to quantify absolute risk contribution?

KT Absolute volatility quantifies portfolio risk as a whole while relative volatility only measures benchmark risk. Absolute volatility is a much more important measure for investors than relative volatility measures such as tracking error. If the benchmark loses 15% and the portfolio only loses 10%, that might be a sign of a good portfolio manager, but it's not great for your portfolio. Absolute risk helps investors understand what risks they're taking regardless of benchmark performance.

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How can factor models be used to construct lower risk portfolios?

DD They help us understand volatility across the portfolio as a whole, not just at the individual security level. For example, if I considered adding an airline security to the portfolio, I would need to consider energy price risk. If energy prices rise, so do fuel costs, posing a risk to the airline's profitability and performance in the market. On the other hand, if I considered adding an oil company to the portfolio, they would benefit from an increase in energy costs and jet fuel prices.

Therefore, I can construct a portfolio that includes both an airline and an energy company, offset the risks in both of those securities, and further reduce portfolio risk as opposed to holding either an airline or an oil company.

The ability to decompose risks via factors is a useful tool for both active and passive managers. Let's explore that in more detail.

KT Factor analysis is very important for passive portfolio managers. Passive managers try to match the returns of a benchmark at the lowest possible cost. They can achieve that goal by not holding as many securities as the benchmark. Factor models enable passive managers to manage their exposures to each of the risk factors rather than just looking at sector or country allocations. Managing these exposures can help mirror the benchmark with a smaller set of securities. They can use optimization tools, which are also typically based on factor models, to construct an optimal portfolio.

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How are factor models used in portfolio optimization?

DD Factor models help clarify the process of optimization. Portfolio optimization lets managers rank their portfolio holdings from most attractive to least attractive. The manager has the option of reallocating assets from the least attractive holdings to the more attractive ones until all the security positions in the portfolio appear equally attractive. Factor models can drive the optimization process by showing the risks at the position level. The manager then has the ability to change position sizes or make other tradeoffs based on how much diversification or concentration is desired in the portfolio.

Performance measurement and attribution is often still separate from the risk function in most buy-side firms. How does the use of factor-based attribution change that dynamic?

KT Traditional attribution is simplistic and the portfolio construction process mirrors performance attribution. For example, a manager may construct a portfolio using sector allocation and security selection within those sectors. Performance is attributed in the same manner, but risk is not a consideration. Factor-based attribution incorporates risk management into the portfolio construction and evaluation process.

Risk becomes part of the process in factor-based attribution and portfolio management. We can explain how factors, and allocations within those factors, add to or subtract from performance.

DD In a formal risk model, we're talking about uncertainty. We are trying to determine the likelihood of the portfolio's outperformance or underperformance. In the attribution process, we can use that same information to determine the likelihood that we would have gotten a particularly good or bad result simply as a matter of chance.

Over time, those evaluations show strengths and weaknesses in the investment process. We know what happened with regard to performance, we have a sense of the range of things that could have happened, and then we can understand the result in context.

Scenario analysis and stress testing are two versatile tools that have been important for investment firms for some time. How is the incorporation of factor models making scenario analysis more realistic for portfolio managers?

KT The traditional method of employing scenario analysis involves changing, or “stressing,” market inputs such as interest, inflation, or FX exchange rates to determine the impact on the portfolio. Stress tests are still useful and part of regulatory compliance such as Dodd-Frank. However, such stress tests can be overly simplistic and incapable of incorporating the impact beyond interest or inflation rate changes in isolation. How is inflation affected by interest rate changes? How does that ripple effect impact equity prices? It is difficult to construct a comprehensive scenario that includes all those market inputs. Factor analysis complements scenario analysis and provides a broader picture.

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DD Scenario analysis using factor models allows us to shift just one or two factors and demonstrate how that could affect other factors and ultimately, the portfolio. Further, factor models enable managers to evaluate the impact of various scenarios on the portfolio directly or on the portfolio relative to the benchmark.

KT I find value in using a combination of stress testing and scenario analysis. Factor models help managers incorporate historical information to make predictions about future events. It’s a good approach when the markets are relatively stable and you want to determine whether your portfolio is exposed to undue risk or whether you’re hedged in case of market changes consistent with historical events.

This raises a further question, what about events that have no precedent, such as a scenario like the 2008 financial crisis? The difficulty here is that no crisis is like the next or the one before. The direct method of shifting different input factors is useful because it facilitates the construction of scenarios that are inconsistent with history. Combining the two approaches ensures the most flexibility.

DD Using factor models for stress testing can illuminate relationships between factors that may not be intuitive. Airlines are a clear example of companies that suffer when oil prices go up. Higher fuel costs negatively impact profitability. However, the companies that get hurt the most by rising oil prices are big box stores such as Home Depot or Lowe’s. The stores themselves require heat and air conditioning. They sell large, bulky goods that must be shipped and shipping costs for such large items are going to impact the company’s bottom line.

Therefore, big box stores are incredibly sensitive to energy costs and that reality is not as obvious as the sensitivity of an airline to the same factor. Factor models let managers observe and understand those contexts that are so important to portfolio risk and performance.

The long stretch of zero and near-zero interest rates and changes in regulations have forced investment managers further out on the yield curve and to ever more illiquid instruments, which can be difficult to value. How do factor models help portfolio managers value assets more accurately and more realistically?

KT There has always been a problem valuing illiquid or privately-held or newly-issued securities for which market prices are not readily available. One way to do that is to use replacement securities. For example, if you are looking to value an IPO in the technology sector, you might use a technology ETF or technology mutual fund as a guideline. That's not a very accurate approach.

Factor models can help determine security prices. First, you can look at a security's factor exposures and perform calculations using very few returns or sporadic pricing that might exist for an illiquid or privately-held instrument. Once you have those calculations, you can project future prices or a current valuation using the returns on those factors and the exposure of the security to those factors. Factor models provide a more accurate measure of volatility than using proxy securities.

A factor model will not provide a yes or no answer to stock selection decisions unless the investment process is extremely quantitative. Factor models can, however, help portfolio managers make allocation decisions.

Given the impact they can have in the investment process and even a firm's culture, what are some considerations firms should bear in mind if they are contemplating adoption of factor models?

DD First, you have to consider time horizon. The question of long term vs. short term may appear simple but establishing consensus in the organization may be challenging, given priorities and concerns among teams at various levels.

Second, investment managers often think of quantitative methods as pure drivers of decision making. A factor model will not provide a yes or no answer to stock selection decisions unless the investment process is extremely quantitative. Factor models can, however, help portfolio managers make allocation decisions. For example, a portfolio manager will want to invest more and take more risk in positions they have greater confidence in. They do not want to assume undue risk in positions where they have less conviction. Taking a more purposeful approach in terms of position size can help drive more consistent performance and not affect any other part of the investment process.

What technological considerations should firms be aware of in incorporating factor models?

KT We talked about using factor models in portfolio construction, performance measurement and attribution, stress testing and scenario analysis, and even valuation. All that relies on having factor models available in the system and ensuring they're the same and consistent across the technology for various parts of the organization. That requires a platform with one set of data, both in terms of the factor models themselves but also in terms of trades positions, security data, and any other relevant characteristics.

The other key point is access to consistent and accurate data. If your data is not accurate, you are less likely to achieve the desired performance goals. Software-as-a-Service or SaaS-based technology places the responsibility for clean and accurate data on the technology provider. One set of data and one platform servicing the entire organization can be key for a successful investment process.

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