Global macro matters

Cycle-based factor timing: Clear in hindsight but hazy ahead

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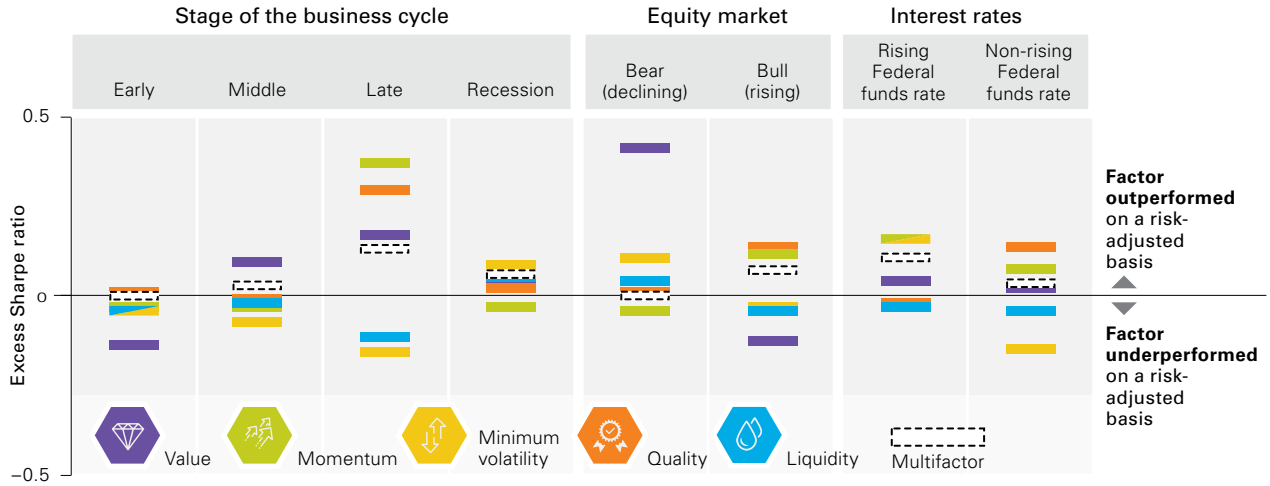
Extensive research has been conducted on the potential benefits of equity factor-based investing. In this paper, we examine how five well-known factors performed historically under various macroeconomic and financial conditions. We then investigate whether investors can leverage this information to improve returns in the current environment of lower expected long-term returns and rising interest rates.[1] Our research concludes that while factors do offer the potential for long-term outperformance, cycle-based factor-timing strategies based on historical returns have not proven to be very successful after adjusting for hindsight bias.

A factor for every environment

Like any form of active investing, equity factor-based investing is highly prone to extended periods of underperformance. The cyclical nature of factor returns led us to question whether US equity factors performed predictably in various economic and financial environments.[2] We selected three widely known sets of conditions: interest rate regimes, equity market phases, and stages of the business cycle. **Figure 1** shows the historical Sharpe ratio of each factor compared with an equally weighted mix (multifactor) and a broad market-capitalisation-weighted equity index in each scenario.[3]

Figure 1. Relative performance has varied by environment



Past performance is not a reliable indicator of future results.

Notes: Sharpe ratios are based on monthly data from 31 March 1973 through 30 September 2018 and calculated as the strategy's excess return over the risk-free rate, divided by the strategy's volatility (standard deviation). Excess Sharpe ratio is the strategy's Sharpe ratio minus the Sharpe ratio of the broad market index. Results are gross of all investment-related costs. The broad market is calculated using US large-cap return; the momentum factor is calculated using a US large-cap high-momentum portfolio; the value factor is calculated using a US large-cap value portfolio; the minimum volatility return is approximated by the low volatility factor; low volatility is calculated using a US equal-weighted low beta portfolio; and the quality factor is the average return of the investment factor and the operating profitability factor. The investment factor is calculated using a US large-cap low-investment portfolio; the operating profitability factor is calculated using a US large-cap high-profitability portfolio; and the liquidity factor is calculated using the average return of US equal-weighted size portfolios. The multifactor category equally weights the five factors studied. Business-cycle stages are as defined in Vanguard Investment Strategy Group (2018). Interest rate cycles are defined based on the effective Federal funds rate from the date of the first hike to the date of the last hike in a cycle, with a six-month minimum requirement (Davis, 2018). Bear markets represent a decline in equity markets of 20% of more, as defined in Philips et al. (2014).

Source: Kenneth R. French Data Library.

1 For more information regarding our long-term return forecasts, see Vanguard Investment Strategy Group (2018).

2 For an assessment of cycle-based performance of global equity factors, see *Equity Factor-Based Investing: A Practitioner's Guide* (Grim et al., 2017).

3 Investors who consider equity factor funds for a timing strategy typically believe that the same factors will outperform a broad-market index fund over the long term without timing. Their objective is for the timing strategy to add to a return that could otherwise be generated by simply buying and holding those factors. For investors without a strong conviction about differences in future expected returns and correlations across factors, an equal-weighted combination is a sensible, diversified standard to determine the true value-add (risk and return) of a timing strategy.

The past is not prologue

As the US economy enters the late stage of the business cycle, investors may view Figure 1 as evidence supporting momentum and quality factor overweights. Historically, they've posted the highest risk-adjusted returns at that stage. Other factor-timing strategies may use similar logic, calculating historical returns and retroactively moving in and out of factors, assuming perfect knowledge of which performed best during which conditions. Voila – a tactical factor strategy emerges with historical evidence of outperformance. This back-testing methodology, called "in-sample", is based on perfect hindsight – an assumption that information known today was also knowable when the strategy was implemented.

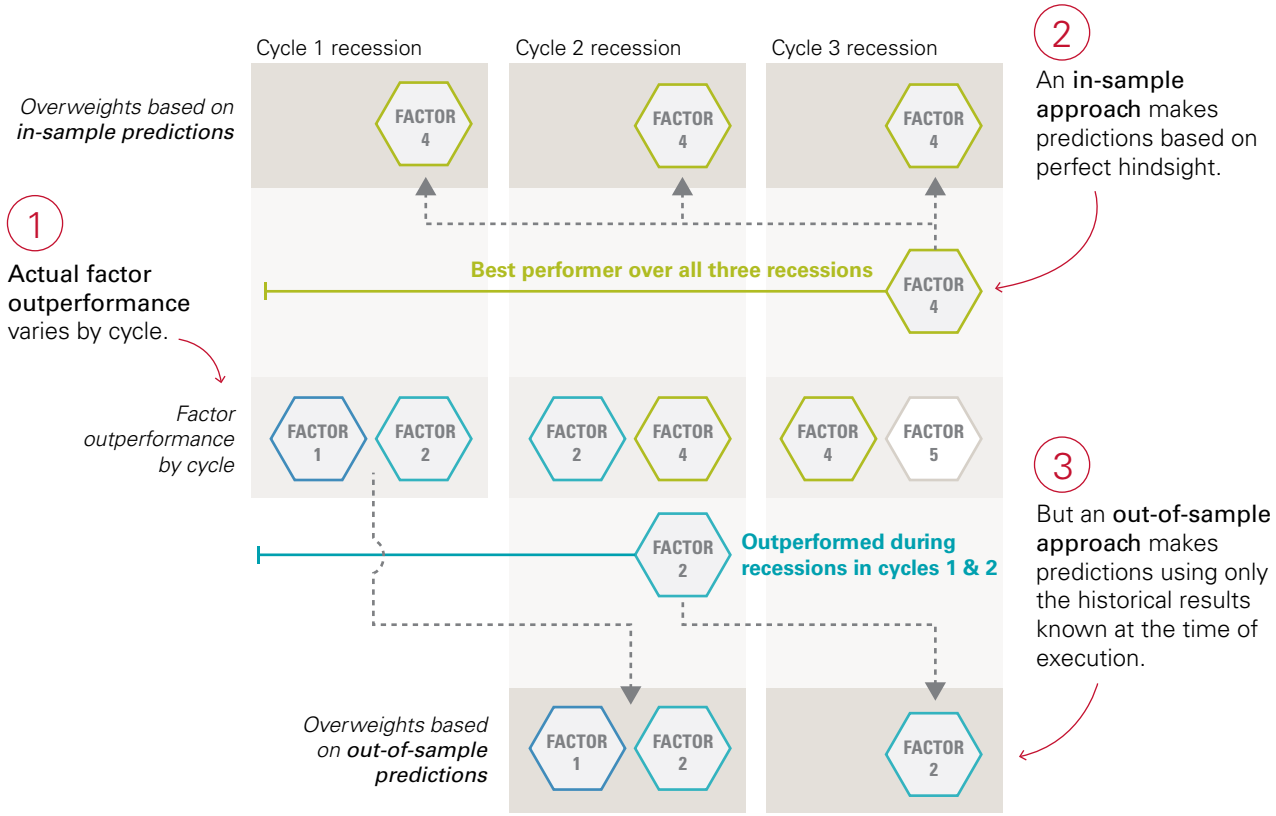
In-sample back-testing analysis can lead to several issues, including potentially inflated returns, as we'll demonstrate later. A more impartial method, the "out-of-sample" approach, uses only the information that was known at the time a temporary factor tilt was implemented. In other words, it is based only on previous results up until that time. Using this approach, we can examine how previous in-sample results actually fared, now that we know what happened afterward.[4]

Figure 2 demonstrates this concept by showing an investor's decisions through time. In this hypothetical example, the in-sample approach identifies Factor 4 as the best-performing factor during recessions and retroactively applies a portfolio overweight during all three recessions that occurred in the time period.

Using a more-realistic out-of-sample approach, the investor learns that Factors 1 and 2 outperformed during the first recession and therefore decides to overweight those factors during the second recession. After the second recession, the investor learns that Factor 2 has outperformed in both recessions and overweights it during the third recession, during which Factors 4 and 5 outperform.

The out-of-sample approach uses only historical results known at the time of execution and demonstrates, in this example, how the investor would have failed to select the factors with the best performance in prior recessions. The in-sample approach unfairly uses the benefit of perfect hindsight to overweight the best-performing factor through all cycles.

Figure 2. Comparison of in-sample and out-of-sample back-testing



Note: This is a hypothetical example for illustrative purposes only.
Source: Vanguard.

4 For a discussion of in-sample versus out-of-sample and the impact on equity market prediction, see Davis et al. (2018) and Asness, Ilmanen, and Maloney (2017).

The impact of hindsight bias

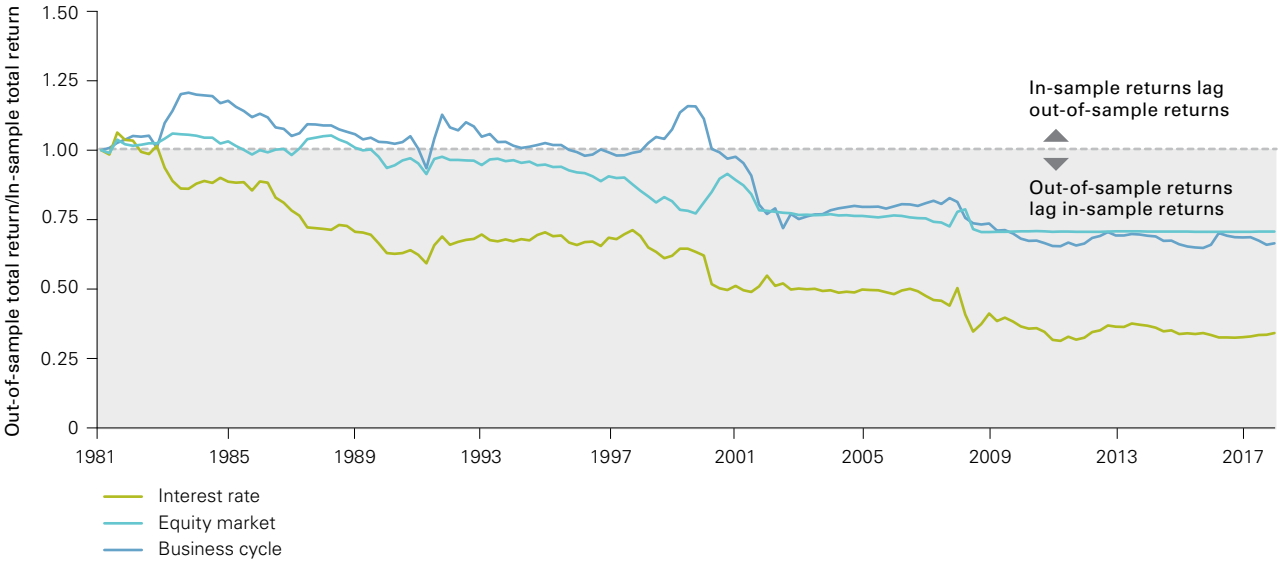
We analysed historical factor returns during various business cycles, bull and bear equity markets, and rising and non-rising interest rate environments using both in-sample and out-of-sample methods. All portfolios were built to match the risk profile (standard deviation) of the equal-weighted multifactor portfolio, ensuring that any outperformance reflected true excess return rather than compensation for bearing additional risk.

We then divided the out-of-sample returns by the in-sample returns. A ratio higher than one signified higher out-of-sample returns. As shown in **Figure 3**, out-of-sample returns lagged significantly. Because investors in the real world don't have the benefit of perfect hindsight and the factors have not tended to behave consistently, out-of-sample results provide a more realistic view of the performance of tactical factor strategies.

Using both in-sample and out-of-sample methods, we implemented a cycle-based factor-timing strategy for the eight environments shown in Figure 1 and compared the returns to a static equally weighted multifactor portfolio with the same level of risk. As shown in **Figure 4,** any excess return from cycle-based factor strategies evaporated when using the more realistic out-of-sample approach.[5]

An additional caveat: Our analysis assumes no ongoing or transaction-related costs and that the investor perfectly foresees the beginning and end dates of each scenario. Investment-related costs and misjudging cycle start and stop dates could materially affect results.

Figure 3. Out-of-sample returns substantially underperformed in-sample returns



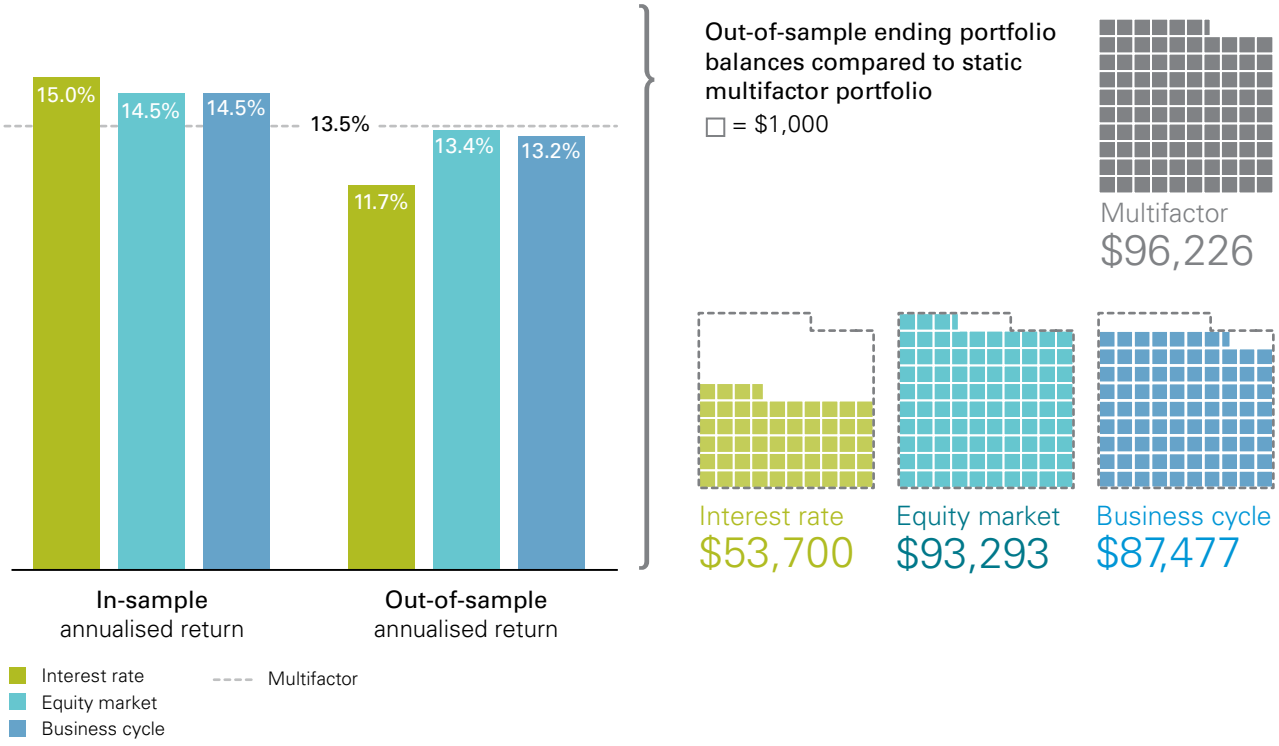
Past performance is not a reliable indicator of future results.

Notes: Results are gross of investment-related costs. For the out-of-sample analysis, we calculated the weight of each factor that would target the volatility of an equal-weighted multifactor portfolio while maximising returns in each cycle using the sample of returns that were available at the time of strategy implementation. We then applied those weights to the next cycle. For the in-sample analysis, we calculated the weight of each factor using the same methodology and the entire sample of returns, and then applied the weights retrospectively in each cycle.

Source: Vanguard calculations based on data from Kenneth R. French Data Library.

5 We also used a simpler approach in which we overweighted factors with Sharpe ratios 20% higher than the market; it yielded similar results.

Figure 4. Historical excess returns vanish when using out-of-sample data



Past performance is not a reliable indicator of future results.

Notes: Returns are based on monthly data from 30 September 1981 through 30 September 2018. The ending portfolio balances assume an initial investment of $1,000 on 30 September 1981 and no additional contributions. Dollar amounts are not adjusted for inflation.

Source: Vanguard.

Conclusion

Using the out-of-sample back-testing method, our research concludes that a balanced, strategic mix of factors has historically performed well versus a tactical factor-timing strategy that makes bets based solely on cycles.

Equity factor-based investing offers the potential for long-term outperformance to investors willing to bear periodic bouts of underperformance. Historical data reveal that certain factors have tended to do better than others in specific environments. However, a cycle-based factor-timing strategy founded on historical performance may not live up to expectation because of inconsistent factor performance in different cycles. Investors must also gauge their ability to accurately identify the key inflection points in economic and financial conditions.

As always, rigorous due diligence when assessing the validity of the strategy is a vital step in identifying hazards, such as hindsight bias, that can greatly exaggerate potential returns.

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Notes on risk

All investments are subject to risk, including the possible loss of the money you invest. Past performance is no guarantee of future results. There is no guarantee that any particular asset allocation or mix of funds will meet your investment objectives or provide you with a given level of income.

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