ANALYSIS

The increasing value of stress-testing investment portfolios

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Extreme market moves can negatively impact portfolios in ways which may not be captured by conventional risk measures, making meaningfully assessing portfolio risks challenging.

Portfolio stress-testing helps identify and quantify risks, helping reassure a manager how their portfolio might respond to significant market events or scenarios that reflect particular concerns.

Stress-testing includes a range of approaches, one classification is outlined in the figure (below). Historical events can provide ideas; however, practitioners can imagine many damaging situations for investigation using artificial scenarios.

Historical versus artificial stress-testing

A major distinction in stress-testing is between historical and artificial scenarios. Historical scenarios replicate previous market events, while artificial scenarios are invented, giving freedom to explore forward-looking concerns or other issues.

Consider Brexit; a currency devaluation scenario could have been explored before the referendum, with response based on previous currency devaluations – a historical scenario. However, if unique Brexit factors are considered, this necessitates an artificial scenario. Brexit has never occurred before, giving no historical data to base it on.

Historical stress-testing's strength is that assets actually behaved that way, adding credibility. Although, if markets have changed since the historical scenario's date (perhaps regulation changes), the response may no longer be possible. Also, historical events can be 'messy' making isolation of individual aspects difficult.

Artificial tests may lack credibility; is the proposed scenario even possible? How can one include all responses, direct and indirect, to portfolio assets? However, they can address anticipated market changes, perhaps regulatory developments, new currencies, or isolate specific concerns.

Historical stress-testing

Historical scenarios have defined start and end dates spanning an interval when assets performed poorly. The asset price movements are applied to determine portfolio response. Approaches include 'value-at-risk' and 'event period' tests.

Value-at-risk (VaR) may assume Gaussian returns distributions, which may be inadequate during stressed periods making 'historical VaR' more appropriate. Historical VaR uses actual returns, usually some period to date. Historical VaR stress-tests incorporate returns from an earlier period to see how these affect the result. Suppose returns from 2014 to 2016 were used.

If a period in 2008 caused concerns, one could include these returns and recalculate the result. Criticisms include using an arbitrarily shaped distribution, loss of returns path-dependency and historical events not being a guide to the future.

Event period tests require crisis start and end dates. These may be less obvious than initially appears. For one index, peaks and troughs can be identified, but across markets historical events may evolve over extended periods with market linkages and feedback.

In portfolios, a decline in one asset may occur while another rises, then the second may collapse while the first recovers. This suggests two approaches; either selecting fixed dates and allowing the rise in one asset to offset the other's decline, or applying maximum declines in each simultaneously. Preserving the timeline makes better economic sense, but is less demanding. Simultaneous price falls make little economic sense, but a tougher test.

Artificial stress-testing

Artificial stress-tests can explore diversification, liquidity events, or shock specific factors.

Diversification requires de-correlated assets. Correlations often increase during market crises. Stress-testing diversification involves increasing some (not all) correlations, quantifying portfolio impact using volatility, VaR, or other measures.

However, correlations can link. Suppose UK, US and Chinese equities have low correlations. Say a test isolates US-UK and UK-China correlations, increasing them significantly; this implies higher US-China correlations.

Hypothetical created event stress-tests use invented scenarios, giving freedom to choose portfolio 'shock' factors. A weakness is the difficulty of inventing economically meaningful scenarios. An envelope approach helps promote consistency and inclusion of important factors. Factors and worst shocks are determined, with scenarios using shock magnitudes within envelope maximums.

Multiple scenarios reflect differing concerns. However, there is no guarantee that scenarios are economically realistic, possible or sufficiently extreme. Diversification is also ignored. The advantage is flexibility to assess any imagined scenario, including regulatory changes or new developments in markets or geopolitics, potentially adding real value.

Implementing portfolio stress-testing

Developing tests requires judgment, using 'unlikely but plausible' assumptions. Managers can help identify issues of concern and scenario severity and should see stress-testing as supporting the investment process, with robust outcomes enhancing reputation.

A stress-testing programme, including documented scenarios, methods and outcomes, with restructuring if necessary, shows that managers are actively protecting portfolio values against extreme market events. This helps demonstrate that managers are working hard to protect client portfolios.

Stress-testing classification Source: Q.G. Rayer, 'Dissecting portfolio stress-testing,' Review of Financial Markets, vol.7, pp.2-7,2015