Artificial portfolio stress-testing and how advisers add value to this process

By Quintin Rayer | May 24, 2017

In previous articles Quintin Rayer gave an overview of portfolio stress-testing, what it can and cannot do, offered a definition, and outlined the range of stress-test methodologies available with a classification, before focusing on historical stress-tests. In this fifth article in the series he explores techniques used in applying artificial stress-tests to portfolios.

Introduction

Extreme market moves can negatively impact portfolios in ways which may not be captured by conventional risk measures, and diversification breakdown may mean that portfolio values are not protected. With guidance[1], stress-testing may be used to estimate portfolio impacts and if necessary appropriate restructuring can limit the downside. Typically stress-testing may look at significant historical market events, or scenarios that reflect particular concerns.

The major distinction is between historical scenarios (re-enactments of past events) and artificial scenarios (invented to capture particular concerns and often involving assumptions) [2]. Apart from the fact that history may not repeat, market developments (perhaps regulation changes) can mean that past financial crises could no longer occur in the same way. Also, historical events can be messy with knock-on effects making it hard to isolate individual aspects of concern.

Artificial Stress-Tests

In this case artificial stress-tests can attempt to include the impact of changes (or anticipated changes) on markets; perhaps regulatory developments, new currencies or new geopolitical developments like Brexit.

Artificial stress-tests can include techniques like hypothetical tests which can look at issues including the robustness of portfolio diversification, liquidity events or shock selected risk-factors. Algorithmic tests attempt to systematically identify worst outcomes within a defined envelope, helping identify sets of changes to market factors that would affect a portfolio most severely.

Created Event Stress-Tests

Created event stress-tests use invented scenarios, giving practitioners' flexibility when choosing factors to 'shock' a portfolio. But it can be difficult to invent economically meaningful scenarios.

An envelope approach [3] can help promote consistency and inclusion of important factors. Stress factors are identified, and the worst possible shock for each determined. A range of scenarios can then be created based on the envelope values. Generally not all factors will be used in any one scenario and the shock magnitudes for the factors selected will be somewhat lower than envelope maximums. Multiple scenarios can reflect differing concerns.

However, this does not ensure that economically consistent scenarios are created, meaning there is no guarantee that the scenarios are realistic, possible or sufficiently extreme. Portfolio diversification is also ignored. These tests have the advantage of flexibility to assess impacts of any imagined scenario, including changes to regulations, new market developments, geopolitics and so-on, which means they can add significant value.

Stress-Testing Diversification

Portfolio managers use de-correlated assets to achieve diversification. However, correlations often increase during market crises, reducing diversification benefits. Stress-testing diversification involves increasing selected correlations using 'covariance matrix' tests. Generally some correlations are increased while leaving others unchanged.
The sizes of correlation changes can be guided by analysing correlation variability, or reflect particular concerns. The impact on diversification can be quantified by portfolio risk measures such as volatility or Value-at-Risk.

However correlations cannot be changed arbitrarily. For example, suppose that Chinese, UK and US equities have low correlations between them. If a test were to isolate US-UK and UK-China correlations and increase these significantly, this also should imply higher US-China correlations. Consequently these tests require the use of various mathematical techniques to ensure correlations are adjusted appropriately.

How advisers can add value

Advisers can play an important role by working with investment managers to help identify suitable portfolio concerns and interpreting test results against portfolio objectives. For stressed scenarios that have little impact on a portfolio, it reassures both advisers and clients that the event may be of lesser concern than feared. Conversely, if a portfolio looks to be badly impacted, an adviser can work with the manager to see how the portfolio can be restructured to make it more resilient.

This helps demonstrate that advisers are working hard to protect portfolios and clients can be reassured that robust investment processes are in place.

References

[1] Advisers are likely to require professional advice on implementation, although some online training is available. Advisers/consultants: P1 Investment Management, Fort Grey Consulting; and Fort Grey online training.
[2] Q. G. Rayer, "Dissecting portfolio stress-testing", Review of Financial Markets, *vol. 7, pp. 2-7, 2015.*
[3] M. Crouhy, D. Galai and R. Mark, "The Essentials of Risk Management", 2nd ed., New York: McGraw-Hill Education, 2014.

This article was written by Dr Quintin Rayer, Head of Investment research at P1 Investment Management and also published on the DISCUS website.

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