WORLD GOLD COUNCIL

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# Managing Portfolio Risk for Periods of Stress

## Gold's Role in Efficient Portfolios

Traditional methods of portfolio diversification often fail when they are most needed – that is, during periods of financial "stress" or instability. On these occasions, the correlations and volatilities of return for most asset classes (including traditional diversifiers such as bonds and alternative assets) all increase together, thus reducing the intended "cushioning" effect of a diversified portfolio. Consequently, the portfolio does not perform as originally expected, leaving investors disappointed.

For instance, in the second half of 1998, almost all asset classes underperformed relative to their long-term averages, and many hedge funds (which are often supposed to act as diversifiers) recorded significant losses. The question therefore arises: how can investors diversify their portfolios effectively and reduce their vulnerability during periods of financial stress? Answer: change the procedure traditionally used for asset allocation.

Accordingly the World Gold Council recently commissioned a study which uses a new methodology that takes into account the behavior of various assets classes during both stable (non-stress) and unstable (stress) periods. Using this new approach, efficient portfolios are developed whose performance is more consistent during both stable and unstable periods. Significantly, the study demonstrates that gold bullion can play a beneficial role in the performance of a wide range of portfolios on the efficient frontier. Indeed, even a small allocation to gold significantly improves the consistency of portfolio performance during stable and unstable financial periods. Greater consistency of performance leads to a desirable outcome – an investor whose expectations are met.

### Traditional Diversification Methods Fail When Most Needed

Institutional investors generally make portfolio diversification decisions based on mean-variance optimization. This approach develops "efficient" portfolios that either maximize returns for an acceptable level of risk, or minimize risk without sacrificing returns. The investor then chooses the desired level of risk/return in order to determine the portfolio's asset allocation. The use of mean-variance optimization, however, suffers from a significant defect. It assumes that the correlation of returns and their volatilities are consistent during both stress and non-stress periods. In fact, history shows that portfolio correlations and volatilities become quite unstable during stress periods. If the asset allocation procedure does not take this instability into account, then portfolio performance will be inconsistent with the investor's expectations.

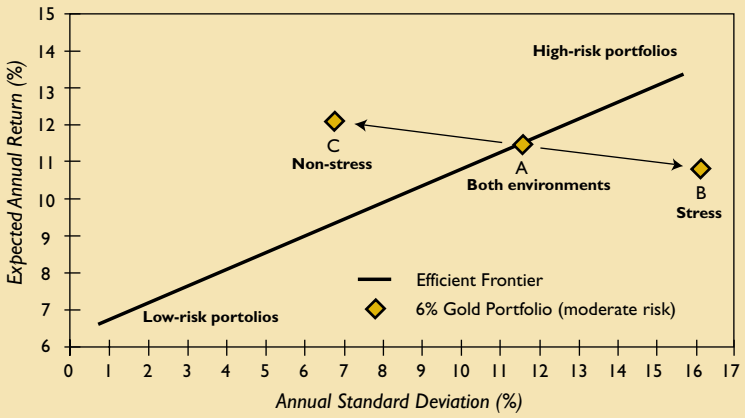
A recent article, "Optimal Portfolios in Good Times and Bad", written by Chow, Jacquier, Kritzman, and Lowery,[1] describes a new optimization procedure which recognizes that periods of stress do in fact occur. Chow uses a statistical procedure based on a Chi-square distribution to determine which monthly return series in the past 30 years have been "unusual". In his study, a little less than one quarter of the monthly returns were unusual for one or more reasons. These unusual episodes are referred to as "stress" periods. The remaining three-quarters of the return series are referred to as "non-stress", or quiet, periods. Subsequently, Chow develops covariance matrices for both stress and non-stress periods to calculate the correlation and volatility statistics to be used in his optimization procedure.

## Gold Helps Reduce Investor Surprise

The goal of the World Gold Council study was to use the Chow approach to create efficient portfolios that would produce similar returns during both stress and non-stress periods. To this end, the returns of various asset classes (including gold) from January 1970 through December 1999 were analyzed. As expected, most asset classes (with the exception of gold) performed poorly during the stress periods; their volatilities nearly doubled, and their correlations increased.

To demonstrate, *chart 1* (below) depicts a portion of the "efficient frontier" curve (black line) using Chow's procedure. The portfolios included on the efficient frontier contain the following asset classes: large cap equities, international equities, Treasury bills, long-term Treasury bonds, small cap equities and gold. The assumption made in developing this efficient frontier is that there is an equal likelihood of either a stress or non-stress period occurring. Notably, gold appears in many portfolios along the efficient frontier, ranging from very conservative, low-risk portfolios (mainly bonds and T-bills) to aggressive, high-risk portfolios (mainly equities).

**chart 1**
**6% Gold Portfolio Performs Well in Both Stress and Non-Stress Environments**




**6% Gold Portfolio (point A)**

| Asset Mix | weighting |
|---|---|
| Large Cap Equities | 27% |
| International Equities | 23 |
| T-Bills | 21 |
| L-T Gov Bonds | 14 |
| Small Cap Equities | 9 |
| Gold bullion | 6 |
| | 100% |
| Standard Deviation | 11.4% |
| Expected Return | 11.6% |

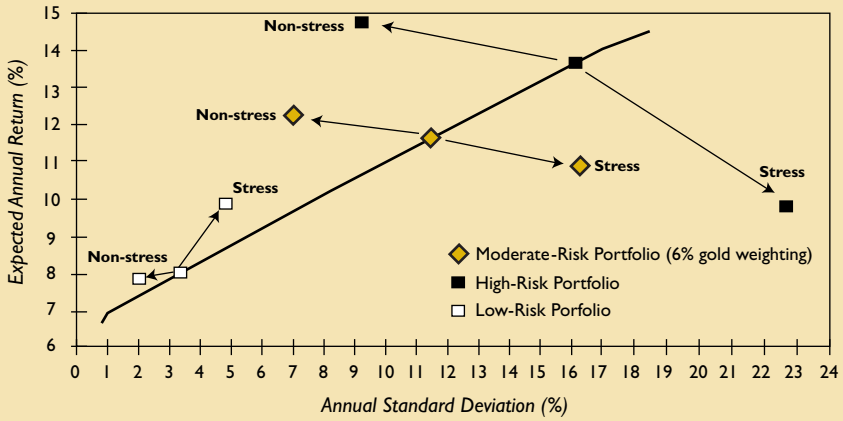
Next, simulations of future returns were conducted for stress and non-stress periods, for a variety of portfolios on the efficient frontier, to test the consistency of their performance.[2] Based on the results of these simulations, a portfolio with a moderate expected risk exposure of 11.4% (standard deviation) and an expected annual return of 11.6% was selected (point A) for two reasons. First, this portfolio had relatively consistent results during both stress and non-stress periods. Second, the expected returns were near the level of returns for a typical 60% stock, 40% bond portfolio. Significantly, this efficient portfolio includes a 6% allocation to gold.

1. *Financial Analyst Journal, May/June 1999: pp. 65-73.*
2. *A Monte Carlo simulation using GARCH techniques was conducted for 5,000 5-year periods of stress and non-stress to provide a broad representation of how the portfolios would perform over a typical 5-year period.*

When stress conditions were simulated on the 6% gold portfolio (point A), the return was 10.8% (point B) – only 60 basis points lower than the expected return of 11.6% for point A – and the standard deviation was 16.1%. Similarly, when non-stress conditions were simulated the return was 12.1% (point C) – 50 basis points higher than expected in point A – and the standard deviation was 6.8%. Thus, the selected portfolio with a 6% gold weighting enjoyed generally similar returns regardless of whether the environment was stress (point B) or non-stress (point C) – a desirable result.

*Chart 2* (below) compares the performance of the moderate-risk 6% gold portfolio with both higher and lower levels of expected risk and return during both stress and non-stress environments. The low-risk portfolio (mostly T-bills) had a lower return and volatility during non-stress periods, but a higher return and volatility during stress periods. On the other hand, the high-risk portfolio (mostly equities) had a higher return and lower volatility during non-stress periods, but a lower return and higher risk during stress periods. High-risk investors are therefore more likely to be disappointed during stress periods. Finally, the moderate-risk portfolio with 6% gold, performs closest to the expected returns during both stress and non-stress periods. This portfolio is therefore less likely to result in unpleasant surprises for the investor.

**chart 2**
**Moderate Risk 6% Gold Portfolio Performs More Consistently Than High and Low-Risk Portfolios**

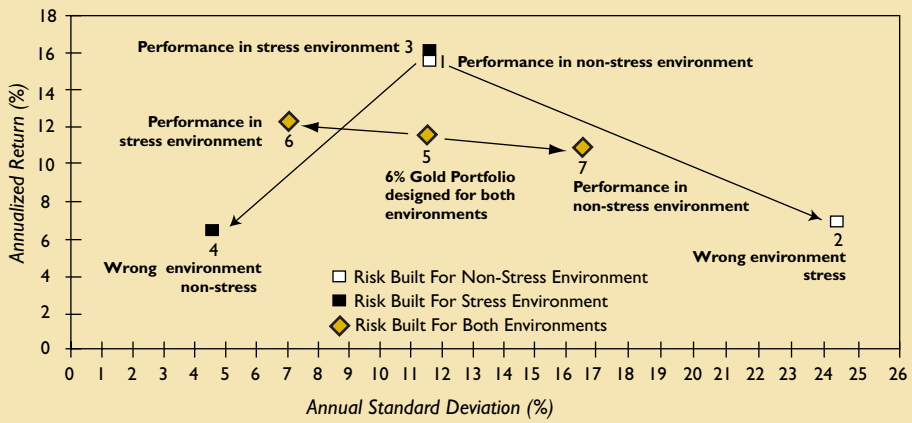



## Cost of Optimizing for the Wrong Environment

It follows that if an investor could correctly forecast the timing of stress periods, portfolios could be developed for optimum performance. These portfolios would contain significant amounts of gold and fixed-income securities. On the other hand, if a non-stress period were expected, the portfolios would emphasize equities and contain little or no gold. Unfortunately, most investors cannot accurately forecast the timing of stress periods. This is a significant consideration for portfolio managers since the cost of being wrong is high. A more robust strategy (to endure both stress and non-stress periods) is, therefore, needed.

For example, as illustrated in *chart 3* (following page), if the investor uses non-stress period assumptions to develop an efficient portfolio with a risk level of 11.4% (the same level used in the previous examples), the portfolio would consist of 100% equities and have an expected annual return of 15.7% (point 1). If, however, the environment turns out to be one of stress, the return would amount to only 6.5% with a high volatility of 24.2% (point 2) or over twice the level originally expected. Such results would no doubt disappoint the investor.

## chart 3
## Cost of Optimizing for the Wrong Environment




| Portfolio For Non-Stress Environment (points 1, 2) | |
|---|---|
| **Asset Mix:** | **weighting** |
| Large Cap Equities | 98 |
| International Equities | 2 |
| T-Bills | 0 |
| L-T Gov Bonds | 0 |
| Small Cap Equities | 0 |
| Gold bullion | 0 |
| | 100% |
| Standard Deviation | 11.4% |
| Expected Return | 15.7% |

| Portfolio For Stress Environment (points 3, 4) | |
|---|---|
| **Asset Mix:** | **weighting** |
| Large Cap Equities | 0 |
| International Equities | 0 |
| T-Bills | 46 |
| L-T Gov Bonds | 16 |
| Small Cap Equities | 9 |
| Gold bullion | 29 |
| | 100% |
| Standard Deviation | 11.4% |
| Expected Return | 16.3% |

| Portfolio For Both Environments (points 5, 6, 7) | |
|---|---|
| **Asset Mix:** | **weighting** |
| Large Cap Equities | 27 |
| International Equities | 23 |
| T-Bills | 21 |
| L-T Gov Bonds | 14 |
| Small Cap Equities | 9 |
| Gold bullion | 6 |
| | 100% |
| Standard Deviation | 11.4% |
| Expected Return | 11.6% |

Conversely, if the investor uses stress period assumptions, the portfolio would have a 29% weighting in gold and over 62% in T-bills and bonds, with an expected annual return of 16.3% (point 3). However, if the environment turned out to be one of non-stress, the volatility of this portfolio would decrease to 4.5% and the compound returns would decline to 6.5% (point 4). In this case, while the portfolio's volatility would be significantly lower than forecast, the return would be disappointing for the investor.

In order to mitigate the two disappointing outcomes described above, a more robust portfolio strategy (to endure both stress and non-stress periods) is needed. The portfolio with a 6% gold allocation (point 5) designed to perform well for both environments yields more consistent rate-of-return results (points 6 and 7) is more likely to meet investor expectations.

### Conclusion

When Chow's technique is used for developing efficient portfolios, it is evident that gold qualifies as a truly effective risk management tool. The moderate-risk portfolio in this study with a gold weighting of 6% yields consistent, predictable returns during both stress and non-stress periods. Thus, gold's ability to diversify helps investors meet their expectations for portfolio performance.

For additional information:

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