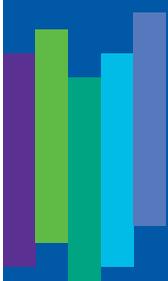


INVESTMENT PRINCIPLES

INFORMATION SHEET FOR CFA PROFESSIONALS

THE BENEFITS OF DIVERSIFICATION

HOW DIVERSIFICATION
REDUCES RISK
AND ENHANCES
COMPOUNDED
RETURNS



3A

IMPORTANT NOTICE

The term "financial advisor" is used here in a general and generic way to refer to any duly authorized person who works in the field of financial services, including the following:

- Investment brokers
- Mutual fund brokers
- Scholarship plan dealers
- Exempt market dealers
- Portfolio managers
- Investment fund managers
- Life insurance agents
- Financial planners (F.Pl.)



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THE BENEFITS OF DIVERSIFICATION

How Diversification Reduces Risk and Enhances Compounded Returns

HOW DIVERSIFICATION REDUCES RISK AND ENHANCES COMPOUNDED RETURNS

Advisors tell their clients they should own diversified portfolios. But why do we diversify and how does diversification help create better performing portfolios in terms of risk and performance? Diversification is not only about avoiding concentrated positions, which can lead to permanent losses, but it is also about achieving the highest average periodic return for a given level of volatility (or its flipside, which is achieving the lowest level of volatility for a given level of average periodic return). Diversification reduces the drain on compounded performance caused by the volatility of returns. But the benefits of diversification on risk and returns can be achieved only if diversification is used in combination with a rebalancing process.

THE CONCEPT OF DIVERSIFICATION

Diversification can be achieved on many different levels. Securities, sectors, asset classes, countries, portfolio characteristics, and even exposure to different types of risk factor (to be discussed in 3c) can be diversified. But the question we wish to answer in this document is not how to achieve an efficiently diversified portfolio in the real economy (that will come later) but rather, how does diversification reduce the risk of a portfolio while enhancing its expected return?

Of course, a basic tenet of diversification is not to put all your eggs in one basket. In recent decades, we have witnessed a large number of spectacular failures of what appeared to be well-established companies, such as Swissair, WorldCom/MCI, Tyco, Arthur Andersen, Enron, Nortel, and so on. But diversification is about much more than simply avoiding huge investment mistakes. To understand the benefits of diversification, it helps to characterize securities and portfolios according to two variables: average periodic

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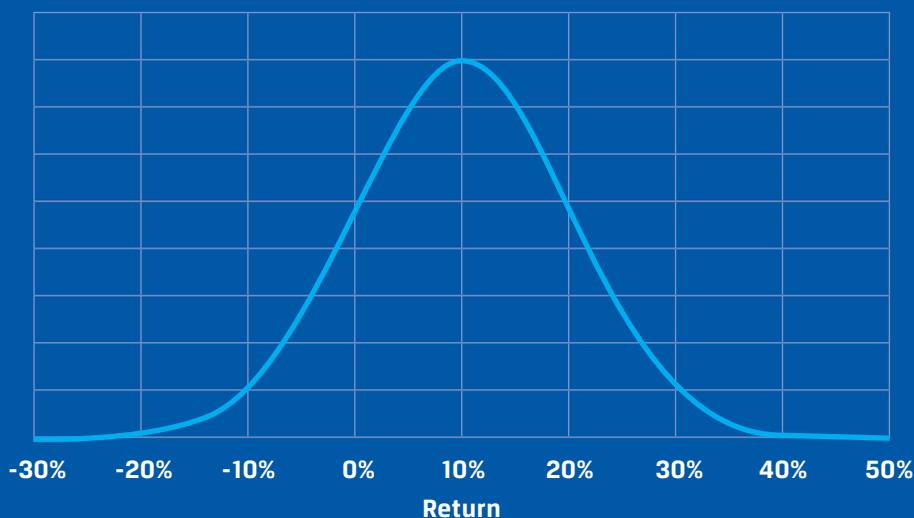
return and risk (as defined here by the standard deviation of periodic returns, which is referred to as volatility). Volatility is a simple measure of return dispersion around the average periodic return. It is computed with the following formula:

$$\sqrt{\frac{\sum_{t=1}^T (r_t - \bar{r}_t)^2}{T - 1}}$$

where r_t , \bar{r}_t and T represents respectively, the return observed during period t (in months, quarters, or years, etc.), the average of periodic returns, and the number of observations. But the equation is not as important as the implication of the results.

For example, let's assume the average return on a security is 10% a year and the volatility of the annual return is also 10%. If we assume that returns follow a normal distribution, a common simplifying assumption, then the measure of volatility captures all the risk, the distribution is centred at 10%, and the shape and density of the bell curve reflect the likelihood of observing specific periodic returns. As the shape of the distribution implies, we are much more likely to observe values that are closer to 10% than farther from it.

MORE SPECIFICALLY, THERE IS A:



- 68% probability that returns over a single period will be within one unit of volatility of the average (0% / 20%);
- 95% probability that returns over a single period will be within two units of volatility of the average (-10% / 30%);
- 99% probability that returns over a single period will be within three units of volatility of the average (-20% / 40%).

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EXAMPLE WITH A BALANCED PORTFOLIO OF EQUITIES AND BONDS

Let's illustrate the concept of diversification and its benefits using a portfolio of two assets over the period from 1990 to 2014. The first asset is an investment in the Russell 1000 Total Return Index and the second is an investment in a fixed-income portfolio consisting of 10-year U.S. Treasury bonds.

	ASSETS		PORTFOLIO
	RUSSELL 1000	TREASURY BONDS	60% RUSSELL / 40% BONDS
Periodic Return	11.50%	7.87%	10.05%
Compounded Return	9.82%	7.61%	9.54%
Volatility	18.49%	7.61%	10.63%

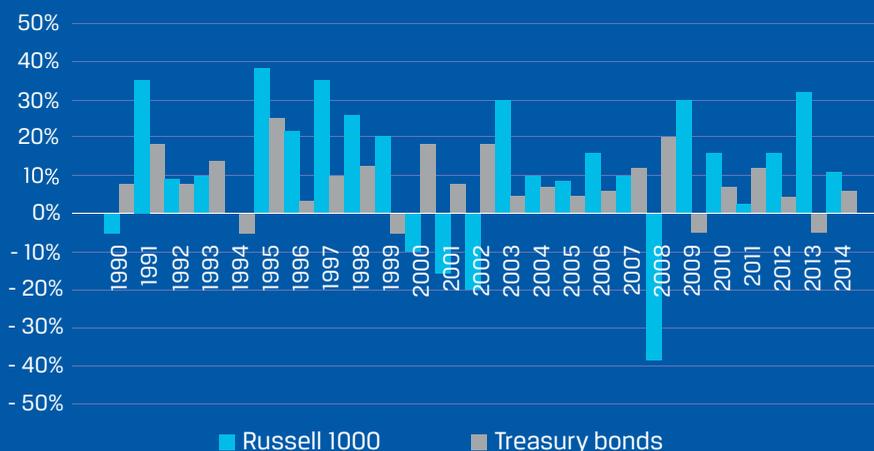
Equities being riskier than Treasury bonds, it is not surprising to observe that the volatility of equities is greater than that of Treasury bonds. In this case, investors were also rewarded for tolerating this greater volatility with a greater compounded return. But that is not always necessarily the case. Even though investors should normally be rewarded for assuming greater risks in the long run, accepting a higher level of risk offers no guarantee that greater returns will in fact be realized. Risk is always about the possibility that rational expectations will not be met. A greater average return on riskier assets is the investor's compensation for bad times. This matter will be discussed in document 3b.

Nevertheless, this example illustrates the benefits of diversification quite well. For example, although the periodic return on the portfolio (10.05%) is simply a weighted average of the periodic return on the two assets, the compounded return on the portfolio almost matches the compounded return on the Russell 1000 (9.54% versus 9.82%) despite having far less volatility (10.63% versus 18.49%). This raises two questions: why is the volatility of the 60/40 portfolio so low and its compounded return so high? The following figure presents the annual return for the Russell 1000 (in blue) and U.S. Treasury bonds (in grey) over this period. The greater volatility of equities is clearly apparent.

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YEARLY RETURNS



The figure shows that equity and Treasury bond returns follow different patterns. Equity returns can be high (low) when Treasury bond returns are low (high). For example, in 2008, equity markets generated one of their worst yearly performances ever while Treasury bonds rallied substantially and had one of their best yearly performances. The reverse was observed in 2009.

These differences in return patterns are often expressed through a measure called correlation, which ranges from -1 to +1. A correlation of 1 implies that there is no diversification benefit because both assets move in tandem. The lower the correlation, the more efficient the diversification. In this example, the correlation between equities and fixed income is low at -0.28, which means it allowed diversification to be very effective at reducing portfolio volatility. Intuitively, we can understand that the correlation between equities and fixed income is likely to be lower than that observed between two bank stocks.

Furthermore, the volatility of a portfolio is less than the weighted average of the volatility of the two assets because of the imperfect correlation (less than 1). But why is the compounded return on the portfolio so high? In section 2b, we explained that volatility reduces an asset's compounded return. Although this is an approximation, we can show that it drains the compounded return by about half of the squared volatility (variance) of this asset. In other words:

$$\text{Average Compounded Return} \approx \text{Average Periodic Return} - \text{Volatility}^2/2$$

Let's consider the example of the Russell 1000. The difference between the periodic return and the compounded return is 1.68% and the square of the volatility (18.49%) divided by 2 is 1.71%, which is pretty close. If we do the same calculation for the 60/40 portfolio, we get 0.51% and 0.56%. The performance of the balanced portfolio benefits from the lower performance drain caused by its lower volatility. We now understand the full extent of the benefits of diversification. Diversification reduces risk and increases compounded returns per unit of periodic return because volatility has a direct negative impact on compounded returns. We now have two good reasons to diversify: to lower risk and to lessen the drain on compounded returns per unit of periodic return.

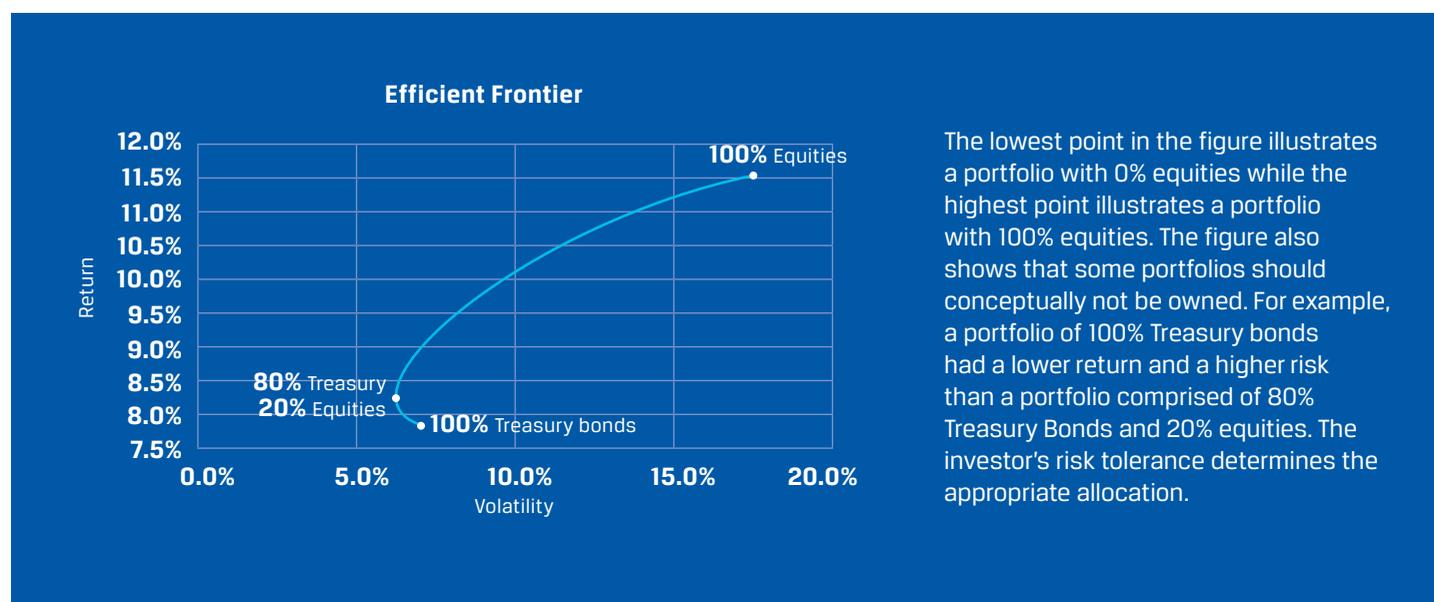
Finally, one crucial aspect of diversification is often overlooked: for diversification to reduce risk and to increase compounded returns as illustrated above, the portfolio has to be rebalanced. Without rebalancing, the benefits of diversification as a means of reducing volatility and increasing compounded returns are simply not fully realized in the long run. Although different rebalancing methodologies can be used, several are similarly efficient (to be discussed in 3f). In this example, we assume that the portfolio is rebalanced to its 60/40 target weight once a year. Thus, if equities outperform Treasury bonds during the year and their weighting increases beyond 60%, some equities will have to be sold and Treasury bonds purchased to bring the target weights back into line.

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THE EFFICIENT FRONTIER AND ITS LIMITATIONS

The efficient frontier is a representation of the different portfolio allocations that allow investors to achieve the best returns for specific levels of risk. It is often used to show investors the benefit of diversifying assets. The following figure shows the different combinations of risks and returns that could have been achieved over the period from 1990 to 2014 if equities and Treasury bonds were combined in different proportions ranging from 0% to 100% equities.



The concept of the efficient frontier is sound but its application in real life is difficult. Efficient frontiers are often built from historical returns and therefore from historical volatilities and historical correlations. Thus, the shape of the figure will be highly sensitive to the period used for the analysis. Investors are concerned with future returns, future volatilities, and future correlations, so efficient frontiers presented to investors can be misleading when it comes to selecting an optimal and appropriate portfolio mix. For example, even

if the efficient frontier derived from the returns observed between 1990 and 2014 indicates that a 100% bond portfolio would have generated an average return of about 7.9% over this period, we can no longer expect such a performance in the coming years considering the current low level of interest rates. But this does not change the fact that diversification will reduce portfolio risk and contribute to higher compounded returns. Therefore, it remains essential to build portfolios that are as efficiently diversified as possible.