CFA Societies Canada

INVESTMENT PRINCIPLES
INFORMATION SHEET FOR CFA PROFESSIONALS

THE POWER OF COMPOUNDED RETURNS

THE IMPACT OF TIME AND PERFORMANCE

2A

Produced by CFA Montréal

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 IMPACT OF TIME AND PERFORMANCE

We save and invest to accumulate wealth so as to achieve an appropriate standard of living in retirement. Many factors affect the accumulation of wealth. Three of these factors are discipline (saving consistently), time (how long we save), and investment performance (what periodic return is achieved on average). Einstein called compounded interest the "most powerful force in the universe" and with good reason. Wealth accumulation not only increases with time and with greater returns, but it also increases at an accelerating pace.

A Simple Example

Let's consider a single investment of $1,000 invested for four years at an annual rate of return of 3% or 6%. At this point, we do not care whether the return comes from interest, dividends, or capital gains. Let's assume it consists of interest. The following table shows how the value of the investment increases after each year.

	YEARLY RETURN = 3%		YEARLY RETURN = 6%	
Time	**Capital**	**Interests**	**Capital**	**Interests**
Now	$1,000		$1,000	
Year One	$1,030	$30	$1,060	$60
Year Two	$1,060.90	$30.90	$1,123.60	$63.30
Year Three	$1,092.73	$31.83	$1,191.02	$67.42
Year Four	$1,125.51	$32.78	$1,262.48	$71.46

The power of compounded returns implies that, as time passes, the investor not only collects interest income on the initial amount of capital invested but will also collect interest income on all interest payments accumulated in previous years. For example, when the investment return is 3%, the yearly interest income increases from $30 in year one to $30.90 in year two, $31.83 in year three and then $32.78 in year four. Not only does interest income increase with time but it also rises at an increasing pace. If the yearly return is 6%, the power of compounded interest is proportionally more significant. Twice as much return implies more than twice the accumulation of capital.

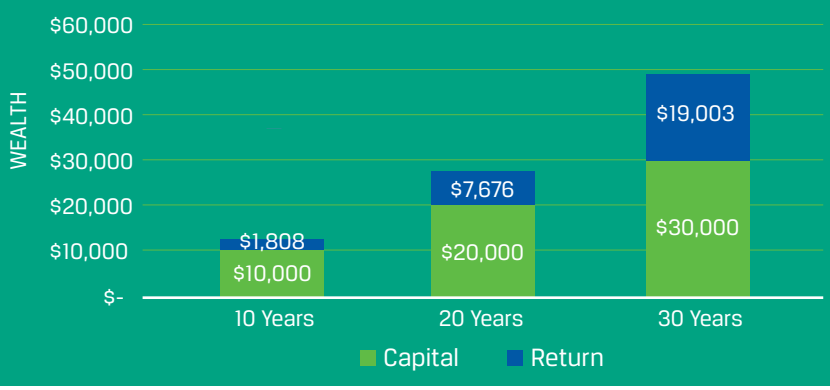
A MORE COMPLETE EXAMPLE

Let's now consider the more realistic example of a periodic investment of $1,000 a year (made at the beginning of the year) at an annual rate of 3% over 10 years. In this case, the final wealth would be $11,808 and it can be attributed to two components:

- $10,000 resulting from 10 capital contributions of $1,000 (84.7% of final wealth); and
- $1,808 resulting from the interest income accumulated over 10 years (15.3% of final wealth).

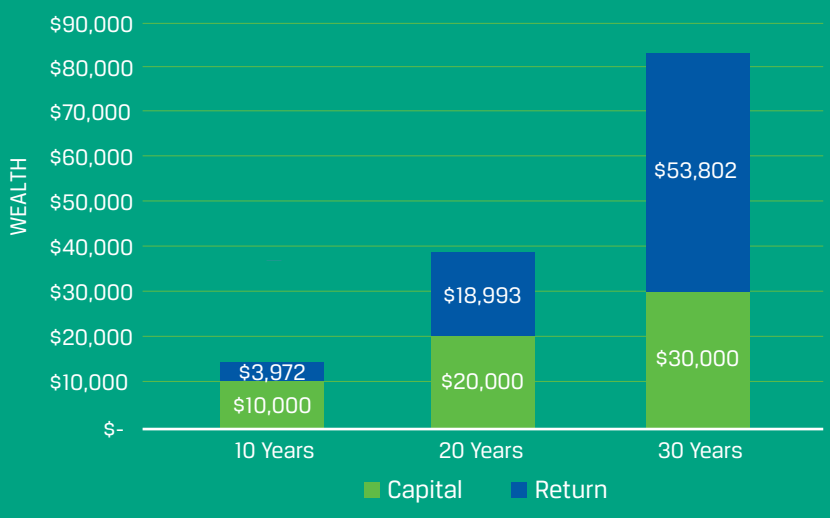
The power of compounded returns also implies that the share of total wealth accounted for by the accumulation of investment income will increase when returns are higher. Furthermore, this share will increase even faster with the passage of time. The two following figures illustrate the impact of compounded returns on final wealth for three horizons (10, 20, and 30 years) and two levels of investment returns (3% and 6%). We maintain our assumption of a $1,000 yearly investment.

SOURCES OF ACCUMULATED WEALTH AT 3% RETURN



The first bar chart shows that, if the annual investment return is 3%, the proportion of the final wealth provided by the accumulation of interest income increases from 15.3% ($1,808 over $11,808) when the investment horizon is 10 years to 38.8% ($19,003 over $49,003) when the investment horizon is 30 years.

SOURCES OF ACCUMULATED WEALTH AT 6% RETURN



The second bar chart shows that the effect of compounded returns is enhanced when returns are higher. For example, if the annual investment return is 6%, the final wealth provided by the accumulation of interest income increases from 28.4% ($3,972 over $13,972) when the investment horizon is 10 years to 64.2% ($53,802 over $83,802) when the investment horizon is 30 years.

There is also another important takeaway from these examples. We have shown that, when the investment horizon is 30 years, the investor will accumulate $49,003 if the investment return is 3%. If the investor starts the savings plan 10 years later (and reduces the investment horizon to only 20 years), she will need to invest $1,771 a year (instead of $1,000) to achieve the same final wealth of $49,003. If the investment return is 6%, the amount of annual savings required climbs to $2,149.

Saving early and regularly is paramount to achieve a better standard of living in retirement. The power of compounded returns increases with the average level of return on investment. Furthermore, this principle applies whether the source of return is interest, dividends, or capital gains. The saving effort required from investors increases significantly if saving starts later in life. Although realizing a greater rate of return on investment is desirable, the achievable return is determined by economic and market conditions but also by the investor's investment policy (how the portfolio is allocated and adjusted over time).

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THE IMPACT OF VOLATILITY

The power of compounded returns is often illustrated with the assumption of a stable periodic rate of return, such as 3% or 6%, every year. In reality, even if an investor realizes an average yearly rate of return of 3% or 6% during her investment horizon, this return is unlikely to be stable. We will show that the uncertainty of investment returns reduces the effectiveness of return compounding. Understanding this aspect will help explain, later on, the full benefits of diversification.

VOLATILITY AMPUTATES FINAL WEALTH

Given a choice, do investors prefer a rate of return of 10% each year for two years (scenario 1) or would they prefer a return of 20% followed by a return of 0% (scenario 2)? In both cases, the *average periodic return* (also called arithmetic return) is 10% ([10% + 10%] / 2 = [20% + 0%] / 2). But the final wealth at the end of the second year will not be the same under each scenario. It is $1,210 in scenario 1 for a total cumulative return of 21% while it is only $1,200 in scenario 2 for a total cumulative return of 20%.

	SCENARIO 1		SCENARIO 2	
Time	**Capital**	**Performance**	**Capital**	**Performance**
Now	$1,000		$1,000	
Year One	$1,100	10%	$1,200	20%
Year Two	$1,210	10%	$1,200	0%
Average Periodic Return		10%		10%
Total Cumulative Return		21%		20%
Average Compounded Return		10%		9.54%

Thus the *average periodic return* does not determine final wealth unless the variability of returns—usually referred to as volatility—is nil as in scenario 1. What determines final wealth is the *average compounded return* (also called the geometric return). For example, the total return in scenario 1 is 21% because:

$$(1 + 10\%) \times (1 + 10\%) - 1 = 21\%$$

In this example, 10% is both the periodic and the compounded return. But to achieve a total cumulative return of 20% in scenario 2, the average compounded return must be 9.54% because:

$$(1 + 9.54\%) \times (1 + 9.54\%) - 1 = 20\%$$

An important general principle of portfolio management is that "volatility drains the ability to compound returns and to accumulate greater final wealth." More specifically:

Average Compounded Return = Average Periodic Return – Adjustment for the Impact of Volatility

The greater the volatility of periodic returns the larger the performance drain. For example, the average periodic yearly return for the Russell 1000 Total Return Index from 1990 to 2014 was 11.50% whereas the compounded return was only 9.82%. The difference is due to the volatility of the Russell 1000s periodic returns.

The fact that volatility drains compounded returns has important implications for portfolio management. It will help us understand, later on, the benefits of diversification and why we often combine different asset classes, such as fixed income and equities, using target weights (for example, 60%/40%), the need to rebalance a portfolio allocation back toward the target when allocation deviations occur because of the relative performance of asset classes, and the benefits of managing and/or limiting volatility to avoid extreme scenarios of negative returns.