

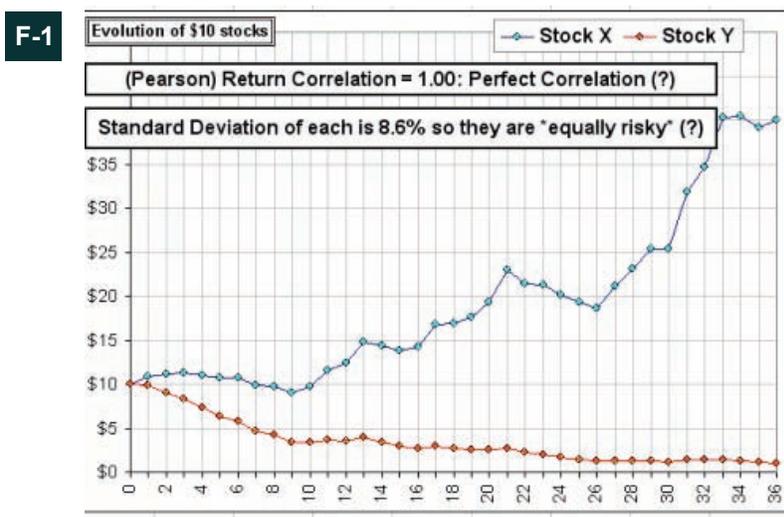
### Risk

What is risk in the investment world? There are many who claim that it is equal to the standard deviation of monthly returns – a common enough assumption that it has been assumed in the latest request for comments regarding the “Fund Facts” proposed amendments:<sup>1</sup> *The proposed explanatory text included above the risk scale is based on the assumption that fund managers use risk classification methodologies based on measures of market volatility, such as standard deviation.*

But consider the following conundrum, highlighted by Dr. Peter Ponzo:<sup>2</sup> consider two securities, which move in tandem – except the first security has a monthly return that is always a constant percentage over the second, as shown in Table F-1:

Period	Security 1 Return	Security 2 Return
1	+8.93%	-1.07%
2	+1.51%	-8.49%
3	+1.69%	-8.31%
...	...	...

After extending the period, with randomized returns for Security 1 which provide the calculated return for Security 2, we can draw Chart F-1 as an example:



Dr. Ponzo asks, quite reasonably:

- Here are 3 years worth of monthly returns, for stocks X and Y
- Both sets of returns have the “SAME” Standard Deviation, namely 8.6%. Therefore (say some experts), they are equally “risky”.
- The Pearson Correlation Coefficient for the returns is 1.00. So (some experts say) their stock prices move in “lock-step”, in the same direction
- Do you agree with either statement?

One might, equally reasonably, object that this example is unrealistic – a higher return should be associated with a higher standard deviation. As the regulators state in their sample “Fund Facts” request for comment: *In most cases, a lower rating means lower risk and lower returns, with a lower chance of losses. A higher rating generally means higher risk and higher returns, with a greater chance of losing money.* This idea, with the word “generally” eliminated throughout, is sometimes referred to as “an iron law of finance”<sup>3</sup>.

<sup>1</sup> CSA NOTICE AND REQUEST FOR COMMENT, IMPLEMENTATION OF STAGE 2 OF POINT OF SALE DISCLOSURE FOR MUTUAL FUNDS, Canadian Securities Administrators 2012-6-21, available on-line at [http://www.osc.gov.on.ca/documents/en/Securities-Category8/csa\\_20120621\\_81-101\\_rfc-stage2-pos.pdf](http://www.osc.gov.on.ca/documents/en/Securities-Category8/csa_20120621_81-101_rfc-stage2-pos.pdf) (accessed 2012-7-12)

<sup>2</sup> Dr. Peter Ponzo, *Perfect Correlation? Risk = Standard Deviation? Huh?*, 2010-12-19, available on-line at <http://www.financialwebbring.org/forum/viewtopic.php?f=29&t=113008&p=408479#p408479> (accessed 2012-7-13)

<sup>3</sup> E.g., Trillium Asset Management, *Strategic View: Can there be a socially responsible hedge fund?(A)*, undated, available on-line at <http://www.trilliuminvest.com/news-articles-category/commentary-news-articles/strategic-view-6/> (accessed 2012-7-13)

There will be many, of course, who will hold that the variance of returns is a good measure of “risk” with such a proviso – but there are two problems with this approach:

- Increasing the specificity of the definition necessarily implies a loss of generality. This is a problem because investment professionals are required to understand the “risk” of each product they sell.<sup>4</sup> Digging deeper into the materials provided by the OSC<sup>5</sup>, we find that “risk” includes not only price volatility, but a host of other things as well:
  - the possibility that a client may lose some or all of the principal amount invested
  - risks relating to the product, such as liquidity risk (including redemption rights and any features that lock in the principal and/or returns for a specified period), price volatility, default risk, and exposure to counterparty risk
  - risks related to assets underlying derivatives or structured products
- There is no information provided regarding how much additional “risk” is justified by a given quantity of excess return (which might be referred to as “risk aversion”).

Dr. Ponzo also posed the question:<sup>6</sup> *If you accept the definition: **Risk = Standard Deviation** then what do you think it's supposed to measure?* This led to an extremely long thread in an Internet discussion forum: the viewpoint I found most entertaining was the idea that since Risk equal to Standard Deviation, then Standard Deviation measures Risk.

I feel that ultimately, risk can only be defined individually, according to the objectives of the portfolio. To attempt to apply a single universal measure of risk to all investments, and to rank investments relative to each other in accordance with their score on this monolithic scale, is ultimately as pointless as trying to rank a hammer, screwdriver and wrench in order of their usefulness as tools. Really, if somebody asked you which tool you wanted to use for a job, wouldn't you want to know what the job was before making your decision?

For example, let us assume I have a large mortgage with four years remaining term and very stiff prepayment penalties when to my gratification, I win the lottery. My winnings will fund an investment portfolio and one of the objectives of the portfolio (perhaps the only objective, depending on the amount of my winnings) is to pay off the mortgage when it becomes due. As an investment professional, what should I invest in to be sure of achieving my objective, while maximizing the amount I can spend on other things?

I claim that the least risky investment in this situation is a four year government strip bond, with an end value equal to the amount required to pay off the mortgage<sup>7</sup>. Interest rates can rise, interest rates can fall, and the market price of the strip bond will vary accordingly, perhaps to a very great extent – but I don't care.

The developers of the “Fund Facts” guidelines might object to my claim that this four year strip is less risky than a three-month treasury bill – after all, the price volatility of my four-year strip is higher than any reasonable projection of that for three-month bills – but I will in turn object that if these funds are invested in Treasury Bills, they will have to be reinvested every three months as they mature. What if market yields decline? My reinvestments will earn less than the projection and I will fall short of my goal of paying off the mortgage.

### ***A Fundamental Statement of the Meaning of Risk***

Any investment portfolio will have a purpose, whether it's to fund retirement spending, accumulate a down payment on a house, or any other objective that the investor has in mind. I suggest that in attempting to define “Risk” as a stand-alone measure, many commenters have simply discarded this very valuable information.

I suggest that generally speaking, “Risk” can be defined as the potential for an investment – or preferably, an investment portfolio – not to achieve its goals, with increasing risk being associated with an increasing chance that those goals will not be met, or an increasing severity of failure.

This is a vague concept – and one that's very hard to model mathematically – but it is the only statement I have ever been able to think of that is sufficiently general to be used to define “Risk” as a stand-alone concept with no modifiers. We can define, when useful, various components of “Risk” when analyzing an investment – credit risk, term-extension risk, even price-volatility risk – but when we do so, we must bear in mind that these are only parts of the puzzle and that to be useful each component of risk must be logically related to the overall meaning of risk.

<sup>4</sup> Ontario Securities Commission, *Business Conduct Requirements*, available on-line at [http://www.osc.gov.on.ca/en/Dealers\\_business-conduct\\_index.htm](http://www.osc.gov.on.ca/en/Dealers_business-conduct_index.htm) (accessed 2012-7-15)

<sup>5</sup> Ontario Securities Commission, *CSA Staff Notice 33-315 – Suitability Obligation and Know Your Product*, available on-line at [http://www.osc.gov.on.ca/en/SecuritiesLaw\\_csa\\_20090902\\_33-315\\_know-your-product.htm](http://www.osc.gov.on.ca/en/SecuritiesLaw_csa_20090902_33-315_know-your-product.htm) (accessed 2012-7-13)

<sup>6</sup> Dr. Peter Ponzo (“gummy”) et al., *Risk = ??*, Financial Webring Forum, 2005-8-26, available on-line at <http://www.financialwebring.org/forum/viewtopic.php?f=29&t=1178> (accessed 2012-7-13)

<sup>7</sup> This investment technique is known as “defeasance” or “cash-flow matching” and is the limiting case of the more general fixed income management technique of immunization.

This is certainly not a new concept – in fact, there was an article<sup>8</sup> in the newspaper on Thursday beatifying Jim Keohane, CEO of the Healthcare of Ontario Pension Plan, for his successful implementation of liability-driven investment strategy: *The core goal of LDI is to more closely match a pension plan's assets with its liabilities.* Sadly, however, the article is marred by a late emphasis on an irrelevancy: *Perhaps the greatest risk comes from what HOOPP is not heavily invested in – equities. If bonds languish for years and if stock markets soar, HOOPP will lose out on returns captured by pension funds with bigger stock portfolios.*

I have to point out that the potential to underperform other pension funds can be considered a risk only if the portfolio objective is to outperform other pension funds. If HOOPP's goal is simply to provide retirement benefits for its members, then the so-called risk of underperformance is irrelevant. Naturally, it would be nice to have excess return, and provide these benefits more cheaply (or, more likely, to provide better benefits for the same price!) ... but that belongs to the concept of Return, not Risk!

### Efficient Frontier with a Fundamental Risk Definition

As suggested by Dr. Ponzo,<sup>9</sup> we can define risk as the chance that the value of a retirement portfolio will fall to zero within thirty years. To this, we will add a definition of Return: the median projected portfolio value after thirty years,, given inflation-adjusted withdrawals of 5.5% of the initial portfolio value. As always, we wish to simultaneously maximize Return while minimizing Risk, with the precise trade-off between the two being a matter of personal taste.

I would feel much more comfortable explaining these concepts of risk and return to an unsophisticated client, than explaining information ratios and standard deviations!

To provide estimates of these figures for various portfolio choices, given reasonable predictions regarding the behaviour of broad asset classes, we will use the Retirement Withdrawals Calculator last discussed in the April, 2012, edition of this newsletter. This calculator is available for download at [http://www.prefblog.com/xls/retirementWithdrawals\\_2012.xls](http://www.prefblog.com/xls/retirementWithdrawals_2012.xls).

Parameters for the set of simulations are as given in Table F-2. Note that the withdrawal rate is a very aggressive 5.50%; this figure was chosen to maximize differences in calculated risk.

**Table F-2: Parameterization of Retirement Withdrawal Calculations**

Parameter	Value
Equity Return Template Start Date	2002-12-8
Equity Return Template End Date	2010-12-8
Equity Return Template Security	Eca.to
Expected Annualized Return	4.50%
Decile Sampling Factor	1.30
Dividend Yield	2.25%
Bonds Expected Return	2.50%
Bonds Coupon	2.50%
Bonds Standard Deviation	5.00%
Correlation Stocks/Bonds	0.50
Inflation	0.00%
Stocks, Percentage	Varies
Bonds, Percentage	Varies
Annuity, Percentage	0.00%
Initial Withdrawal Rate	5.50%

Applying the values of Table F-2 to a retirement withdrawal calculation gives rise to Table F-3:

Table F-3: Results of Simulations		
Proportion Equities	Median End Value ("Return")	Proportion of Ruin ("Risk")
0.01%	-26,000	94.3%
10%	-18,000	75.4%
20%	-6,000	56.8%
30%	91,000	42.0%
40%	201,000	36.7%
50%	312,000	33.8%
60%	421,000	31.8%
70%	451,000	32.8%
80%	476,000	33.6%
90%	451,000	35.5%
99.99%	355,000	40.4%

<sup>8</sup> Janet McFarland, *HOOPP: Risky business, healthy payoff*, Globe and Mail, 2012-7-12, available on-line at <http://www.theglobeandmail.com/globe-investor/investment-ideas/hoopp-risky-business-healthy-payoff/article4414197/> (accessed 2012-7-15)

<sup>9</sup> Dr. Peter Ponzo, *Risk: how to measure it?*, Gummy Stuff, available on-line at [http://www.financialwebring.org/gummy-stuff/Risk\\_Measures.htm#RISKIER](http://www.financialwebring.org/gummy-stuff/Risk_Measures.htm#RISKIER) (accessed 2012-7-13)

The return distribution for the 60%-equity portfolio is shown in Chart F-2, while the efficient frontier using the data from Table F-3 is shown in Chart F-3. The efficient frontier using the more standard definitions – that “Return” is the expected annual total return of the portfolio and that “Risk” is the expected variance of the this return – is plotted in Chart F-4.

To say that there is a major difference in the efficient frontier defined in these two manners is to understate the matter! Very different conclusions regarding optimal portfolio mix will be drawn by investors provided only with only one of these two charts as aids to retirement withdrawal planning.

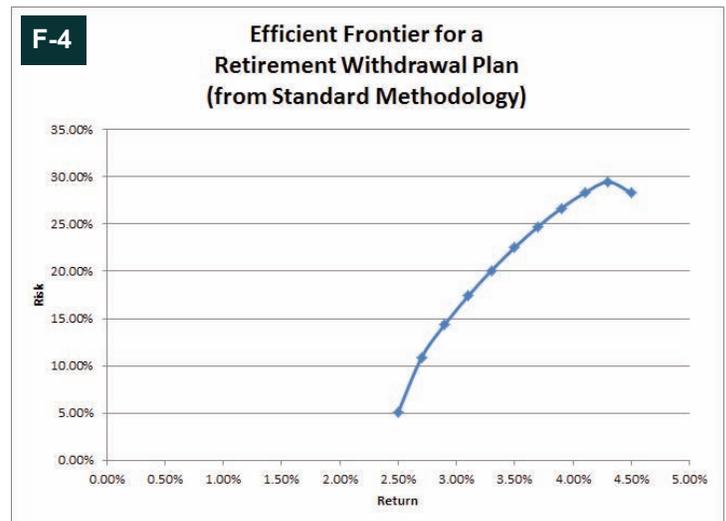
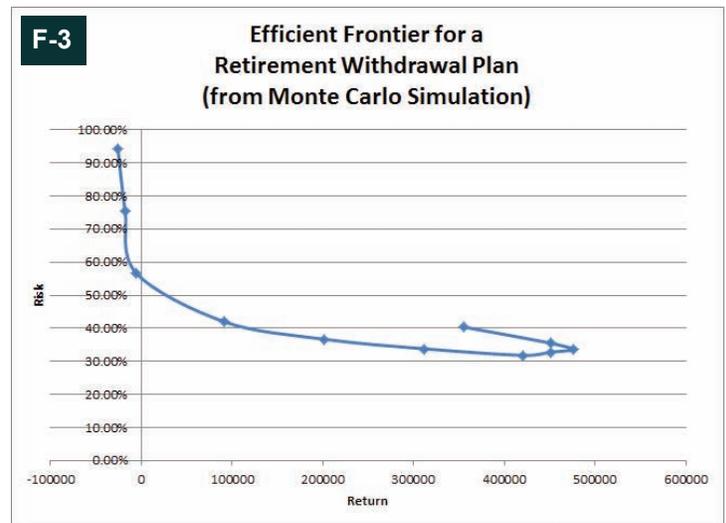
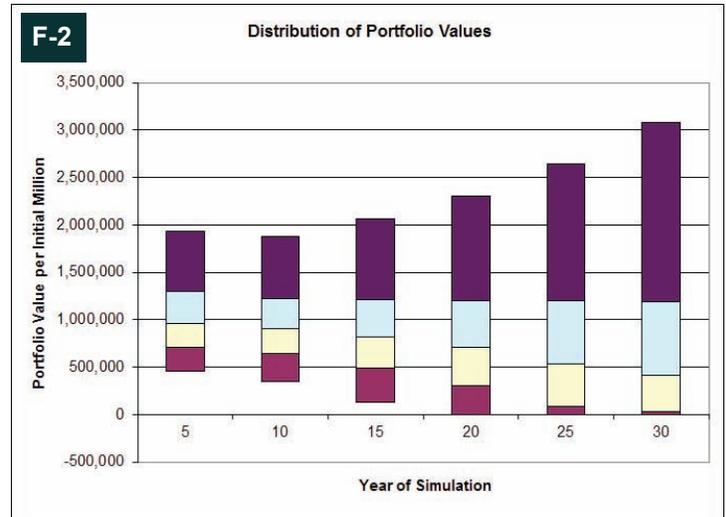
**Investment Conclusions**

When formulating an investment plan, investors should consider very carefully just what exactly it is they wish to accomplish – in real life terms, not in terms of investment baffle-gab – and seek to construct a portfolio that will accomplish that. In many cases, of course, investors will discover to their chagrin that the easiest way to reduce their risk is to reduce their expectations; but that can be a useful exercise in itself!

Naturally, this can get complicated, but a focus on an identifiable outcome will prove much more useful than more vague objectives such as “outperforming such and such an index by so much” or “achieving an information ratio of greater than 1.5”.

And, in the end, what do decimal places matter? William Bernstein points out:<sup>10</sup> *Realize that these [calculated retirement portfolio survival] probabilities are merely an imperfect estimate of the investment risk you are taking. In other words, they assume the continuity of financial and political institutions over the period studied. ... A wildly optimistic historian might give us another few centuries of economic, political, and military continuity. Back-of-the-envelope, that's about an 80% survival rate over the next 40 years. Thus, any estimate of long-term financial success greater than about 80% is meaningless.*

Now, let's return to the above table. The historically naïve investor (or academic) might consider reducing his monthly withdrawals to a very low level to maximize his chances of success. But history teaches us that depriving ourselves to boost our 40-year success probability much beyond 80% is a fool's errand, since all you are doing is increasing the probability of failure for political, economic, and military reasons relative to the failure of banal financial planning.



<sup>10</sup> William J. Bernstein, *The Retirement Calculator from Hell, Part III, Efficient Frontier*, 2001, available on-line at <http://www.efficientfrontier.com/ef/901/hell3.htm> (accessed 2012-7-13)