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VALUE INVESTING IN CANADA: RECENT EXPERIENCE AND DRIVERS OF PERFORMANCE

By Alex Chomski

Value investing is an investment approach employed by a number of institutional investors. A traditional division classifies an equity manager investment style as either growth- or value-oriented. While a growth-oriented investment-style manager focuses on companies with consistent earnings, growth and momentum, a value-oriented style manager targets companies with low stock prices in relation to their earnings or asset values. In the investment management industry, a number of active managers specialize in one of those two investment styles, and typically benchmark their performance to specific style indices, while some others do not follow a specific investment style.

In this article, we will analyze the recent value investing experience in the Canadian equity market, determine the main macroeconomic variables that drove the value cycle performance in that period, and draw some conclusions about the benefits of style rotation between value- and growth-oriented styles in the management of an investment portfolio.

Extensive academic research supports the distinctive behavior of growth and value stocks. One of the considerations of that research has been the proposal and testing of the existence of a value premium that rewards value investors for the additional risk undertaken. According to that research, the value premium simply reflects an adequate compensation for an investment with a distinctive risk profile. Research from Fama and French (1993)[1], for instance, supported the idea that value stocks can perform better than growth stocks over a sufficiently long investment period. These ideas were later confirmed by some empirical studies such as the one elaborated by Campbell and Vuolteenaho (2003)[2], which determined that value stocks have significantly higher cash-flow betas than growth stocks, a factor that explained their higher average returns. In addition, Lettau and Wachter (2005)[3], introduced a duration-based explanation for the value premium, where growth companies possess high-duration assets while value companies are char-

CONTINUED ON **PAGE 4**

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CHAIRPERSON'S CORNER

We have a turbulent time ahead of us. Although scary, the opportunities can be great if our profession continues to be proactive and to evolve with its environment. Rapidly changing demographics, technology, economies, and the inter-relationships among them have been creating a more complex world. We can't afford to rely on investment strategies and long-term financial planning techniques that were developed decades ago for much different times.

For several decades, expected returns have served as the crux of "long-term" financial planning for individuals, pensions and many social programs. Unfortunately, after a decade of sub-par returns, it is evident there are shortcomings to this approach. Equity returns were essentially flat in the 2000s, yet annual expected returns for the asset class commonly hovered around 10 percent. What other actuarial assumption has been off by more than 15,000 bps within a decade?

Historical returns often serve as the foundation for establishing return expectations. However, it's debatable whether historical returns are even relevant. We live in a complex global economy. Technological advances can change our perception of reality in an instant and can drive not only how global wealth is allocated among and within countries, but also how the global population is distributed. Even more, economic cycles are driven by demographics and technological advances yet, at the same time, are one of the largest drivers of how both factors evolve. Improving our understanding of these relationships, and recognizing the weaknesses of traditional expected return methodologies, should lead to more realistic expectations and to more sustainable social policies.

In the spring, we plan to host a summit regarding long-term financial planning. It will serve as an initial step towards addressing these issues by exploring both how to improve our process for setting expectations, and how to avoid relying on return expectations all together. Subsequent steps will depend on the results of the summit, but will likely include a coordinated effort with other sections (e.g., pension, futurism, long-term care, etc.) and possibly other professional organizations (e.g., CFA Institute). Ultimately, we want to assure actuaries will play an integral role in a sustainable solution.

In addition, there are a number of other items we have been working on, including:

- At the annual meeting, we awarded Jeremy Gold with the Redington Prize for his paper "The Intersection of Pensions & Enterprise Risk Management."
- In January, we surveyed our members to assess where we should focus resources and what areas could use improvement.
- Our annual Investment Symposium will be in New York on March 26–27, 2012 and will feature a new retirement/pension track as well as a number of well-known speak-

ers, including Michael Peskin, Jeremy Gold, Zvi Bodie, Marty Leibowitz, Ron Ryan, Bud Haslett, Emanuel Derman, and Aaron Brown.

- We are partnering with other sections that have similar goals. For example, we are working with the International Section to expand membership outside of North America.

Our objective is to create value for our members. Given that we have limited resources, it is important for us to understand what you value most. Please take a few minutes to respond to our upcoming survey. In the meantime, we hope you enjoy this edition of *Risks & Rewards!*

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"HERE OVER THE LAST DECADES, A SIGNIFICANT NUMBER OF STUDIES HAVE ARGUED IN FAVOR OF THE EXISTENCE OF A VALUE PREMIUM IN EQUITY MARKETS FOR EXTENDED INVESTMENT HORIZONS."

acterized by low-duration assets, given the expected timing of their cash flows over time. In that line, it is expected that long duration assets will be more sensitive to interest rate changes, such as changes in the discount rate, than short duration assets anticipated to be more sensitive to cash flow changes.

This article is organized as follows. The first section provides the analysis of risk-adjusted returns for value and growth investing in Canada during the 1999–2011 period. The second section assesses the value cycles and the variables that had influenced those cycles during that timeframe. The third section formalizes the analysis by providing quantitative analysis of the main drivers of value investing. The final section, describes the implications of that analysis for the management of equity portfolios.

A. PERFORMANCE EVALUATION: RISK-ADJUSTED RETURNS

Over the last decades, a significant number of studies have argued in favor of the existence of a value premium in equity markets for extended investment horizons. In this section, we will assess the existence of that premium in the Canadian equity market. The analysis will cover a period that starts in March 1999 and ends in March 2011, a period that includes two major market events very different in nature: the tech bubble and the recent financial crisis.

Risk-adjusted returns provide a comparable metric to evaluate investment performance among alternative portfolios. One of those measures is the traditional Sharpe ratio, which describes the return in excess of a risk-free rate that a portfolio could deliver per unit of risk. Sharpe ratios for alternative performance rolling investment periods were assessed from 1999 to 2011. Those periods reflect some typical investment horizons that institutional investors apply when assessing their investment managers.

Table I

Sharpe Ratios

	Value	Growth
3 yr rolling average	1.94	0.67
4 yr rolling average	1.75	0.67
5 yr rolling average	1.79	0.63
7 yr rolling average	1.60	0.30
10 yr rolling average	0.72	(0.47)

Table I above shows three- to 10-years rolling average Sharpe ratios for value and growth indices.

As the table exhibits, the value index had consistently outperformed the growth index when measured by the Sharpe ratio across all the rolling investment periods. In addition, it could be seen that the longer the time horizon, the higher the dominance that the value index Sharpe ratio had over the corresponding growth index ratio. The tech bubble burst in the early 2000s, explains the more disappointing performance of the growth index Sharpe ratio over longer periods, as its impact is greater over a reduced number of rolling periods. For instance, by September 2002, the growth index lost 36 percent of its February 1999 value and did not recover that loss until February 2005. Shorter rolling averages periods, by contrast, were less influenced by those gloomy years. Overall, the Sharpe ratios describe a superior performance of the value index relative to the growth index when compared in terms of risk-adjusted returns.

B. VALUE CYCLE

This section will focus on assessing which variables had the greatest influence on the value cycle.

The first variable that was considered was the risk aversion and the U.S. market-based VIX index was used as the proxy for the Canadian equity market volatility. That index

measures the volatility of a portfolio of options on the S&P 500 index and was tested to be significantly correlated with a similarly built Canadian index. Chart I (right) shows that since March 1999 until March 2011, there was a notable inverse relationship between the value index and the market risk aversion, as measured by the VIX index. Four phases were identified during that period:

- The first phase started with the tech bubble burst in 2000 and extended until March 2002. During that period, risk aversion soared significantly while value stocks performed poorly.

- The second period, which began in March 2002 and finished in March 2007, was a period of declining risk aversion and extremely positive return performance for value stocks represented by the value index. A long bull stock market characterized that phase.

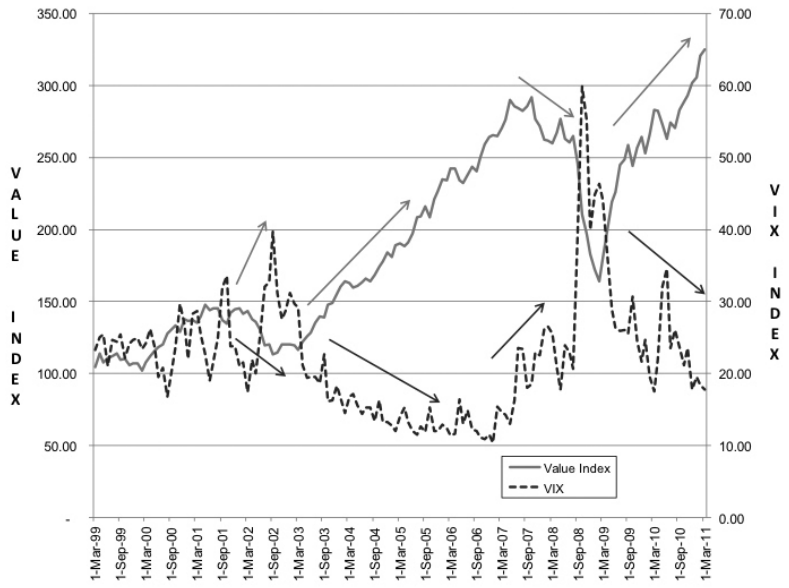
- The third period comprised the recent financial crisis where risk aversion reached unchartered territory, spiking in September 2008 with the Lehman Brothers bankruptcy, and an associated price slump in value stocks that ended in March 2009.

- The final phase embraces the aftermath of the financial crisis with a normalization of the risk appetite into historical levels and a consequent increase in the value index.

Although past market behavior does not guarantee similar future developments, the recent performance of the value index tends to support the expectation that value stocks will become increasingly attractive when market risk aversion declines. This observation will be tested with quantitative methods in Section C.

Value indices typically have higher exposure to financials, industrials and utilities sectors while growth indices are generally more heavily weighted into information technology and health care sectors. As a result, from a macroeconomic point of view, a value index is expected to have more sensitivity to the economic cycle than a growth index and, consequently, to be significantly more sensitive to interest rates and GDP changes.

Chart I
Value Cycle and Risk Aversion



Source: Bloomberg

The first variable we will focus on is interest rates, specifically short-term interest rates, as value stocks are expected to have a relatively shorter duration and be more sensitive

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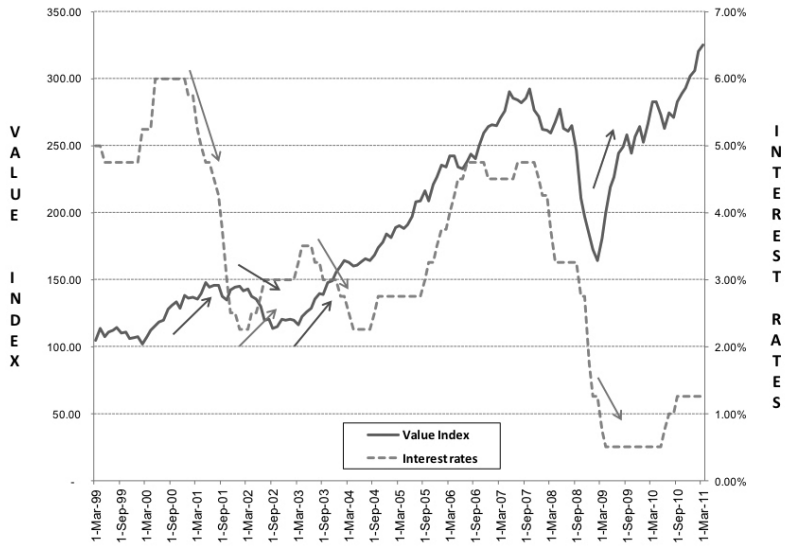
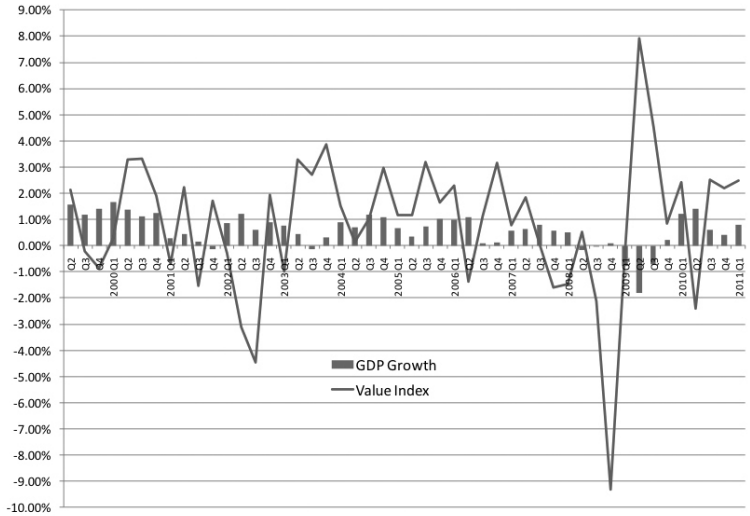
> "A NUMBER OF SINGLE AND MULTIPLE VARIABLES REGRESSIONS WERE RUN TO ANALYZE THE MAIN FACTORS AFFECTING THAT DOMESTIC VALUE INDEX."

Chart II
Value Cycle and Interest Rates



Source: Bank of Canada

Chart III
Value Cycle and GDP Growth



Source: Statistics Canada

to those rates than growth stocks. Extensive literature supports the idea that the value premium is a compensation for holding riskier assets as value stocks are typically more leveraged, have more unproductive capital and, as a result, are more subject to some macroeconomic risks such as changes in interest rates.

Chart II (left) confirms that the value stock index performed better during periods of declining interest rates. Value firms benefit from the reduction in their cost of capital and improved expected macroeconomic conditions as a consequence of more relaxed monetary conditions.

The second variable we will concentrate on is GDP growth. Chart III (below, left) shows quarterly changes in GDP and the value index. As the chart shows, declines in the value index tended to be associated, with some lag, to declines or slowdown in economic activity.

Overall, the charts described above illustrate that risk aversion, short-term interest rates and GDP growth were variables that had substantial impact in the performance of the Canadian value index. In the next section, we will perform quantitative analysis to assess their relative strength.

C. QUANTITATIVE ANALYSIS

In this section, we will assess the existence and strength of relationships between macroeconomic and market variables and the performance of the Canadian value index. A number of single and multiple variables regressions were run to analyze the main factors affecting that domestic value index. The regressions results are presented in Table II.

Table II

March 1999-March 2011

				Value index with		
	GDP	Int rates	VIX	VIX & GDP	Int rates & GDP	Int rates, VIX & GDP
Coefficients	6.90	-0.74	-1.60	-1.15	5.74	4.09
				6.83	7.35	-0.97
						7.14
t Stat	-30.88	-4.59	-2.57	-5.51	-4.19	-3.07
				-33.50	-30.25	-30.79
						-4.58
Adjusted R-Squared	0.87	0.12	0.04	0.89	0.88	0.90

The regressions results support the following conclusions:

- GDP growth was consistently the main explanatory variable of the value index movements across single and multiple variables regressions.
- GDP growth was found not only to have the highest regression coefficients in single and multiple variable regressions, but also to be consistently statistically significant at a 2 percent significance level across all the regressions on the value index.
- The VIX and interest rates variables were statistically significant at a 2 percent significance level in all the regressions on the value index.
- Individually, GDP growth was the single variable with the highest adjusted R-Squared, far beyond the corresponding values for interest rates and VIX index-based regressions.
- When GDP growth is combined with any other variables (interest rates or VIX), the multiple independent variables regressions increases the explanatory power of the regression when compared to a single variable GDP growth-based regression. However, the increase in the explanatory power of multiple variables regressions was marginal when compared to that single variable GDP-based regression.
- The regression with the largest number of independent variables had the highest adjusted R-Squared of all of the regressions on the value index.
- The VIX index had a consistently negative relationship with the value index suggesting that increases in risk aversion were associated with declines in the value index.

D. CONCLUSIONS

The analysis of the performance of a Canadian value index during the 1999–2011 period found that the value index had a superior risk-adjusted return performance than the growth index.

The value cycle in the Canadian equity market was influenced by macroeconomic variables such as interest rates and domestic GDP growth as well as other market-related variables such as investors' risk aversion.

CONTINUED ON **PAGE 8**

A quantitative analysis confirmed that domestic GDP growth was the most relevant variable to explain changes in the market value of the value index. Although interest rates and risk appetite had a role in explaining changes in that index, their individual contributions to those index changes were minor compared to the GDP growth variable as a single factor. In fact, it is conceivable that the impact of interest rates on the index is not achieved directly but indirectly through the GDP growth, as monetary policies are expected to act in advance of anticipated changes in GDP growth.

The consistently negative relationship between the value and VIX index suggests that increases in risk aversion tend to be detrimental to the performance of the value index.

The results of this study confirm that in the recent experience, value indices tend to shine at the beginning of recessionary environments with declining interest rates and risk aversion and darken as the economic cycle matures. This fact has notable consequences for active managers whose investment mandates are not constrained to a single investment style. Those managers could incorporate style rotation in the management of their domestic equity portfolios during the value cycle and, as a result, maximize their risk-adjusted return performance over that cycle.

*The views and opinions expressed in this article are solely those of the author and are not representative of the author's employer.

END NOTES

[1] Fama, Eugene F. and Kenneth R, French (1993). "Common Risk Factors in the Returns on Stocks and Bonds", *Journal of Financial Economics.*

[2] John Y. Campbell and Tuomo Vuolteenaho (August 2003), "Bad Beta, Good Beta", Harvard University.

[3] Martin Lettau and Jessica A. Wachter (2005). "Why is Long Horizon Equity Less Risky? A duration-based explanation of the value premium", NBER Working Papers 11144.

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http://HealthSpringMeeting.soa.org.

TAKING STOCK: DEBT, CURRENCIES, INFLATION AND THE REDISTRIBUTION OF WEALTH

By Nino Boezio

Excessive debt, economic weakness and extraordinary levels of monetary stimulus have been some of the major stories that have dominated the headlines for the past several years. These have played a role in stock market volatility, the rise of gold, major fluctuations in currency exchange rates, and the rise and fall of various segments of the global bond market.

The United States, United Kingdom, Europe and Japan have had to struggle with high levels of government debt. The ability to support and sustain just the interest payments have called into question the credit quality of the underlying fixed income investments, resulting in several rating agency downgrades of the issuing countries' sovereign debt. We previously lived in a world where we often viewed government as the last line of defense to save the country from economic, natural or other crises generated by a variety of internal or external factors (whether caused by bad business decisions, the supposed failure of regulatory or market mechanisms, or by environmental or social factors such as earthquakes or war). Governments (through their agencies) always appeared available as a last resort to come to the rescue of the economy. Now we face a situation where many countries are in financial trouble and there are few aid options available, especially given the size of the problem. Many of the global bodies that could have helped in the past cannot effectively do so now given their limited resources and established mandates, unless there is also some major structural change in how things are financed and in the way issues are addressed (but even then, the global situation can still be an insurmountable problem given its current complexity).

GROW AND CUTBACK ECONOMICS

In its simplest terms, countries in financial difficulty today are still expected to grow out of their problems through strong economic performance while reducing expenditures at the government level. This was certainly the formula being applied to Greece throughout much of 2011 (even though many knew this was wishful thinking, given that the Greek debt burden was simply too large relative to the size of its economy and its government revenues). This grow and cutback solution can work if a country is willing to sustain pain for several years and the rest of the world is willing to pick up the slack that includes buying that country's goods and indirectly stimulating the economy, especially when the domestic country's federal government and local consumer are now less active (some have cited how Canada had similar financial problems in the 1990s, but its fiscal restraint and relatively low currency helped it grow out of its problems, and with large thanks during those years to its wealthy and prosperous neighbor, the United States).

Unfortunately today, we have too many countries in the same financial dilemma while also having a dominant position in the world economy. For example in terms of currencies, the United States cannot truly depreciate its dollar too much (through various indirect policy actions) to help its domestic economy via exports, since it is such a major player in the global economy. It cannot be expected that a large number of smaller countries can help the United States grow out of its problems, especially when the role was the opposite not too long ago. Also too many countries may want to adopt a similar strategy (whether it be the United Kingdom or the Eurozone), so it becomes a competing race to weaken a currency, with the only beneficiary truly being gold, as investors want to seek an investment that can preserve value. Japan has also wanted a weak yen to help counteract its regularly contracting economy, but this has often been met with very limited success due to other factors (i.e., the yen has often behaved as a safe haven currency in times of global economic crisis, thereby negating any currency devaluation strategy). And as we have seen with individual European countries, the currency devaluation option is no longer available given that this part of their national sovereignty was surrendered to the Euro regime. I am not implying that currency devaluation is a primary tool or policy used by most governments, but it is something that can arise as a byproduct of any policy action, and may be desired under certain circumstances.

Austerity measures that try to balance a budget through reduced expenditures also pose many difficulties, because such policies will inevitably slow the local economy unless

something else takes the government's place. Investor confidence spurred by government action can also be short-lived and it does not often translate to better economic performance. And poorer economic performance will cause a balanced budget to become unbalanced once tax revenues fall. We also often forget the painful human consequences that may arise, such as public despair and protests that can occur from tough austerity policies. Negative public reaction and social unrest can wear on the emotions of government officials, and can result in deviations from previously agreed promises to keep government costs in line (as we saw with Greece when the national referendum idea was temporarily being floated—a referendum would have been a good means to shift the pressures elsewhere given the public resentment to austerity).

The big question currently is whether any proposed growth and fiscal restraint economic strategies will work for many of the national economies that have embraced them. For some countries it may, and for others (probably many) it will not, at least not completely. The magnitude of growth and fiscal restraint required is often just too large, and government projections of a future balance between government revenues and expenditures tend to be overly optimistic. And unfortunately, too many countries are trying to do the same thing at the same time today, in turn hurting each other and the global economy.

CURRENCY WEAKNESS ARISING FROM BAILOUTS

A good currency as I would define it would be one that preserves its value relatively well over time, and this can occur when the economy is stable, the country's debt is very manageable, government spending is not too high relative to the size of the economy, and there is little inflation.

When the U.S. Federal Reserve adopted monetary expansion policies aimed at buying assets and increasing the money supply (often cited as Quantitative Easing programs, named successively as QE1 and QE2, running from Sept./Nov. 2008 to March 2010, and from Nov. 2010 to June 2011 respectively) some voiced concerns that it would raise the likelihood of inflation. Higher inflation expectations made sense—more money in the system meant more cash was going to chase fewer goods. This never truly happened—many organizations and investors did not spend the cash, but either saved it, paid down debt or invested it in vehicles such as the stock market (Technically, some described what had occurred as a decline in the velocity of money, as the increase of cash in the economic system did not produce an increase in the demand for goods and an extension of credit to borrowers as was previously hoped. Commercial banks actually held on to much of the cash rather than lending it, negating much of the U.S. Fed's intended financial stimulus.).

The other concern was that any monetary expansive policies would devalue the U.S. currency. QE1 and QE2 did fulfill this expectation as we witnessed foreign currencies performing better relative to the U.S. dollar, but with also a dramatic rise in commodity prices. Ironically, the rise in the price of commodities likely resulted in some economic drag on the U.S. economy, but that is another story.

Europe to date has not adopted any direct monetary expansive policies even though the trend or long-term expectation appears to be in that direction, as central authorities seek to buy sovereign debt and improve liquidity. Europe originally relied on internal funding sources (e.g., Germany, France, Italy, Spain) to keep economic partners such as Greece afloat. However, several of these major contributing countries may now need some sort of bailout themselves, and countries such as Germany are not an endless source of cash to help its European partners.

In October 2011, global stock markets rallied sharply when it was announced that agencies such as the European Financial Stability Facility (EFSF), which was created in the spring of 2010, were being expanded to include greater financial resources to buy assets, similar to what the U.S.

CONTINUED ON **PAGE 12**

Fed had done several years ago (to about $1 trillion in U.S. dollar terms, see table below), with additional help to come from the European Central Bank (ECB) in various forms as needed. But with countries such as Italy subsequently raising worries (which had debt itself of more than $2 trillion in U.S. dollar terms) the EFSF was not always considered to be big enough to cover all potential claims. In addition, the seed money to support the EFSF appeared questionable given that such large amounts are required, and few countries can truly be involved as large net contributors. Germany cannot be expected to carry a larger part of the EFSF if things get significantly worse. The additional strategy of selling bonds in the bond market to fund the EFSF was also not successful, and this is a rather awkward strategy to say the least, since this bond money will be used to buy other bonds of lesser quality (and, of course, with the serious credibility problem surrounding many European bonds today in terms of being secure, it was not surprising

EFSF issues are backed by guarantees given by the 17 euro area Member States for up to €780 billion in accordance with their share in the paid-up capital of the European Central Bank (see table below)

	New EFSF Guarantee Committments (€m)	New EFSF contribution key (%)	EFSF Amended Guarantee Committments* (€m)	EFSF amended contribution key* (%)
Austria	21,639	2.78	21,639	2.99
Belgium	27,032	3.47	27,032	3.72
Cyprus	1,526	0.20	1,526	0.21
Estonia	1,995	0.26	1,995	0.27
Finland	13,974	1.79	13,974	1.92
France	158,488	20.31	158,488	21.83
Germany	211,046	27.06	211,046	29.07
Greece	21,898	2.81	-	0.00
Ireland	12,378	1.59	-	0.00
Italy	139,268	17.86	139,268	19.18
Luxembourg	1,947	0.25	1,947	0.27
Malta	704	0.09	704	0.10
Netherlands	44,446	5.70	44,446	6.12
Portugal	19,507	2.50	-	0.00
Slovakia	7,728	0.99	7,728	1.06
Slovenia	3,664	0.47	3,664	0.51
Spain	92,544	11.87	92,544	12.75
Total	**779,783**	**100**	**726,000**	**100**

* The amended contribution key takes into account the stepping out of Greece, Ireland and Portugal.

Source: "European Financial Stability Facility", <www.efsf.europa.eu> [path: http://www.efsf.europa.eu/attachments/faq_en.pdf], November 9, 2011

> THE BEST OPTION FOR AN ENTITY TO TRULY DEAL WITH SUCH A MONUMENTAL DEBT PROBLEM MAY BE TO MANAGE ITSELF OUT OF IT THROUGH MONETARY EXPANSION AND BY THE RESULTING INFLATION.

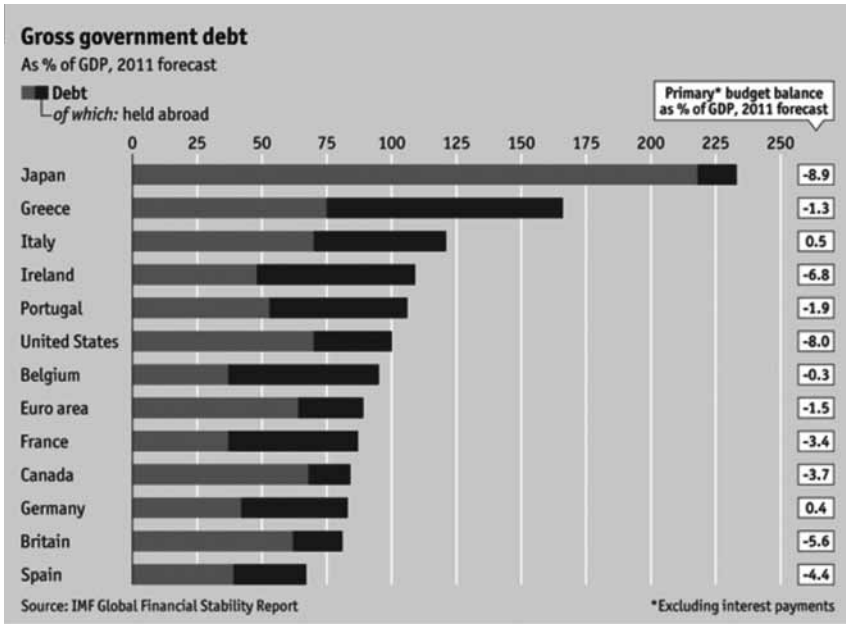
that the EFSF bonds received poor investor demand). Ideas were also circulated to sell some other type of European bond, but in the end it will be the same old thing, just with different packaging. The use of the International Monetary Fund (IMF) has also been put forward as an additional means of alleviating the stresses of the current financial situation, but the question still remains as to where is all of this new money going to come from, especially given that the IMF itself is significantly funded by the regions which are now facing difficulty, and it also has other priorities.

It is not completely clear if there will also be a need to tap into newly created fiat money through the ECB as the U.S. Fed did to pay for its additionally assumed obligations, but it should be expected given that all of the other strategies currently being used are proving unsuccessful to date (And once this approach of monetary expansion is taken, we suddenly have a new large pool of financial reserves to use to buy assets without the need for countries to contribute real money.). Such an approach can probably solve many of Europe's short-term problems while creating large risks for future generations to address.

The best option for an entity to truly deal with such a monumental debt problem may be to manage itself out of it through monetary expansion and by the resulting inflation. This course is increasingly being seen as where things are ultimately headed for continental Europe, unless countries are allowed to default and leave the Euro currency (currently considered to be a much more disastrous alternative). The best option does not mean it is an attractive option, but rather the best of a long unpleasant list of choices, with each choice expected to produce a different set of bad consequences.

WEALTH REDISTRIBUTION AND THE LIKELY RETURN OF HIGH INFLATION

Inflation ultimately solves problems, but rather painfully as history has shown. To get rid of, reduce or manage overly-large amounts of debt, one has to default, devalue or postpone paying at least part of it. A default hurts many investors since capital (the principal) is lost. Postponing the payment of debt can be perceived as a partial default, as the terms of debt repayment are violated and the payback schedule is less attractive than previously agreed. A debt devaluation can occur by not paying the debt completely dollar-for-dollar. But an artificial debt devaluation through an inflationary spiral (which may be less visible initially) can accomplish much of the same thing that all of the current global policy jockeying is trying to achieve, and it can be a better way to relieve the stress on segments of the global economy. Currently there is no appetite to allow countries such as Greece to default, given the potential domino effect it can have on Europe and the rest of the world (The world saw the "unexpected" damage created when the firm Lehman Brothers was allowed to go down, and it does not want to venture into that territory again.).

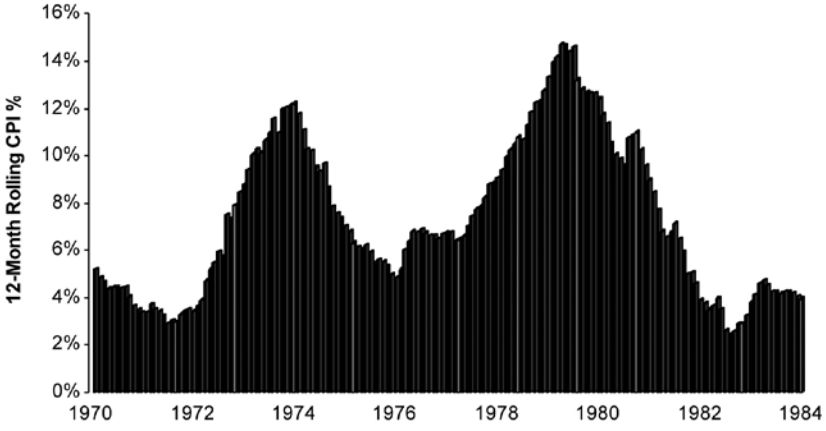


Source: "Debt, deficits and markets", <www.economist.com> [path: http://www.economist.com/blogs/dailychart/2011/09/government-debt], September 21, 2011

By decreasing the value of debt in nominal terms, a country's economy becomes relatively bigger and thereby so does its tax revenues, and it is therefore better able to sustain its debt service costs. Of course to play the inflation game, long-term investors, particularly those in fixed income securities will get hurt. Retirees could find themselves falling significantly behind as occurred in the 1970s and early 1980s (for example, during the 10-year period of Dec. 1972 to Dec. 1982, purchasing power fell by more than 50 percent based on change in the U.S. CPI). Uncertainty about the future prospects and growth of the country's businesses also increases as inflation concerns rise dramatically, making equity investors nervous.

Unfortunately certain groups of investors will have to suffer because of the past financial mistakes of others. Some will complain about this inequity as wealth implicitly becomes redistributed to some degree to other financial and market participants. But there appears to be no other feasible solution for solving the big issues facing the world today, given the magnitude of the problem and the overall goal of achieving the greater good of a domestic or global economy. If a nation's debt can be reduced in real terms by, say, more than 50 percent, this could really set the stage for a new economic boom.

U.S. Rate of Inflation 1971-1984



CONCLUSION

As some have worried, we are entering uncharted territory for countries such as the United States and the Eurozone, as large amounts of money are being expended to stave off major global financial crises. Countries and governments often hope that they can push limits of debt, monetary expansion and spending without suffering major negative financial consequences (as occurred with infamous countries such as Zimbabwe, where its money has become virtually worthless) and perhaps somehow with future stronger economic growth and fiscal restraint, things are brought back into control.

The United States has embarked on its experiment successfully so far without suffering major consequences, since the additional money in the system was not truly spent. Fear and weak economic performance has in general kept fixed income yields low worldwide, but this situation cannot continue forever. Extra money if not subsequently withdrawn from any financial system, will have to eventually move somewhere, creating either inflation or an asset bubble. The Eurozone to date has fought strongly against a monetarily expansive policy due to inflation concerns and has wanted to fund its problems through existing sources of funding, but its pools of money are not endless. If presented with a serious economic downturn and multiple pressures due to its debt burdens, Europe may have to consider additional policies that encourage cheap and new money and which are by their nature inflationary.

It is hard to envision a current scenario where many of the troubled countries of Europe can pay down their debts through austerity and economic growth. The United States,

United Kingdom and Japan face similar challenges. The required magnitudes of adjustment are simply too large. Assets purchased by newly created money backed by the faith and credit standing of a country and facilitated through a government agency such as a central bank, can solve the problems in the short-term. However, for future high inflation to be avoided, any large amounts of debt created to fund expenditures have to eventually be paid back, and any new money introduced into the system has to be subsequently withdrawn.

One has to be highly skeptical that a policy unwinding down the road can be accomplished successfully, given that too many things have to go right. We are unfortunately living under a global economic system where sovereign debt has simply run too far relative to the strength of the issuing countries to support it through internal revenues, and prospects for strong economic growth in the impacted regions are not too optimistic.

Dislocations have to be remedied. The bet today is high inflation has to come back since the present course appears impossible to reverse. Yields on fixed income investments in turn will also have to go up as inflation concerns rise, which may be a good thing for those that hold high liability obligations relative to assets (such as many defined benefit pension plans).

High inflation is probably the best means to reduce global debt in real or nominal terms, and it may be imposed upon us by market forces, especially if national and government behavior is no longer considered effective or acceptable.

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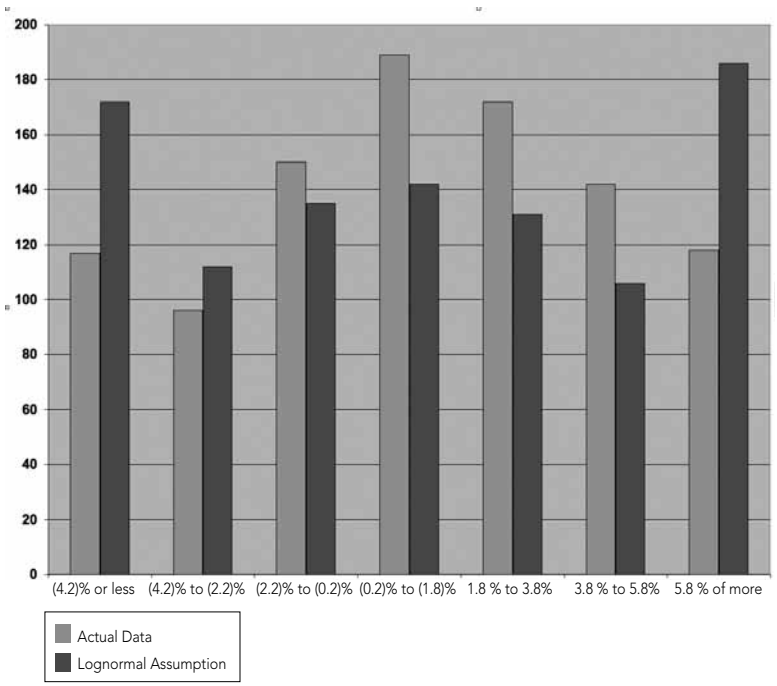
A FRESH LOOK AT LOGNORMAL FORECASTING

By Richard R. Joss

One of the significant contributions of modern academic finance has been to introduce the concept of stochastic investment forecasting. For example, using a Monte Carlo simulation, a forecaster can use actual historical returns to create a whole series of possible future scenarios. Using this technique it is possible not only to provide an expected rate of investment return, but a complete distribution of such returns. In short, using the Monte Carlo technique one could say that the expected return on large company stock investments might be 12 percent, but that there is a 30 percent chance that such an investment could exceed a return of 25 percent for the year. On the down side, it is also possible to say that there is a 30 percent chance that the equity investment could lose money for the year.

Instead of using the Monte Carlo technique, it is possible to create a mathematically derived formula that can be used to create the probability distribution of stock returns.

Actual Data Distribution Compared with Lognormal Assumption



It has been common to assume that this distribution may be described by a lognormal probability density function. (See Appendix 1) Once the parameters mu and sigma are selected for the lognormal distribution, the mathematical approach may be used to provide probabilistic forecasts that are equivalent to forecasts developed using the Monte Carlo techniques.

However, actual experience (such as that exhibited by 401(k) plan participants) has fallen short of expected results. This 401(k) shortfall even made the Nightly News on NBC on Feb. 27, 2011, and was the lead article in the Oct. 19, 2009, issue of TIME Magazine. Both these general news sources cited studies showing that the average near-term 401(k) retiree only had about 25 percent of the funds that he or she was expected to have in order to be able to retire. Thus, the shortfall is really quite significant. While it is easy to blame the markets or poor investment choices on the part of participants as a significant part of the shortfall, perhaps faulty forecasting is also a contributing factor. With that as background, this article takes a fresh look at lognormal forecasting.

LOGNORMAL FORECASTING

As noted above, it has been common to assume that distributions of stock market returns may be modeled using the lognormal probability density function. To select the lognormal probability density function parameters, finance textbooks provide detailed instructions using the arithmetic mean and sample standard deviation from a set of historical returns. What is often missing, however, is a comparison of the actual historical results, and the expected results provided by the lognormal probability density function. This comparison is not as good as one might expect given the widespread use of this particular model. To illustrate this point, the *2008 Ibbotson and Associates SBBI Yearbook* provides of history of 984 months of large company stock return data. The chart to the left compares the distribution of the actual data with the expected distribution provided by the best estimate lognormal density function.

As an example of the difference between the two distributions, the actual distribution shows that for 118 of the 984 months (12 percent of the total) stock returns were 5.8 percent or more for the month. Whereas the best estimate lognormal density function assumes that 186 out of 984 months (19 percent of the total) will have a return that is 5.8 percent or more in the future. This is a substantial difference. It calls into question the use of the basic lognormal probability density function to describe the historical data, and seems to indicate that there may be a fundamental problem with the common lognormal approach.

USING CONDITIONAL PROBABILITIES

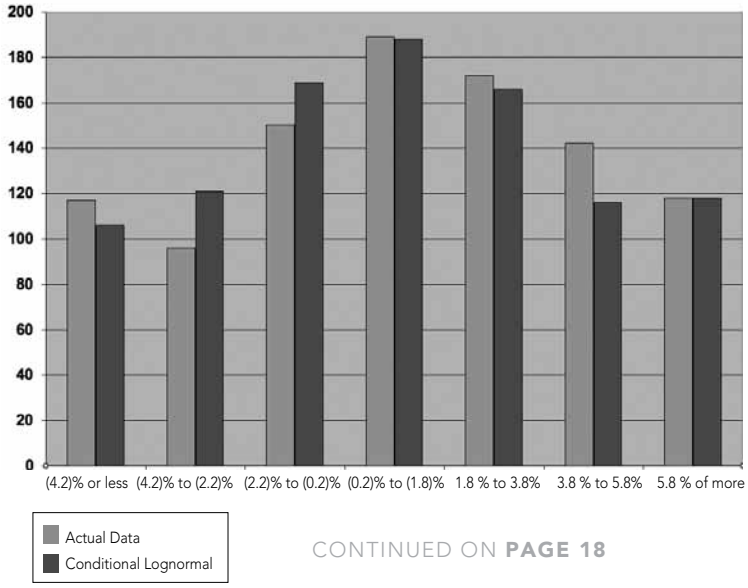
It is interesting to note that the traditional method of selecting lognormal parameters involves the use of the arithmetic mean of a set of historical data. The arithmetic mean of a set of historical data must, of mathematical necessity, always exceed the actual rate of wealth growth. If a fund is to grow at a 5 percent annual rate for a given day, the arithmetic mean of the hourly returns (when expressed as annualized values) must exceed this number. If an investment is to grow at a 0 percent rate for a given month, the arithmetic mean of the annualized daily values must be positive. In each case these higher arithmetic means are just a natural byproduct of the wealth accumulation process. The higher arithmetic means add nothing to the ending wealth.

It has been common in academic finance to say that the best estimate of next year's return will be 12 percent. But the only way that this can occur is if the monthly returns for the year exceed their long-term average of 1 percent. The monthly returns would have to have an average of 1.2 percent or so in order for the end of year wealth to be at the 12 percent rate, assuming stocks exhibit their normal volatility. If it is assumed that the arithmetic mean of the returns for the next 12 months will be the 1 percent historical average, the annual return for the year must be a number that is less than the historically observed 12 percent return, perhaps a number like the geometric mean of 10 percent. It is mathematically impossible to have both the 1 percent monthly rate and the 12 percent annual rate occur simultaneously, if one assumes stocks exhibit normal volatility.

As one contemplates the source of historical investment return data, it is clear that they are periodic observations of a single long-term historical asset growth. As such, the mathematical theory of probability and statistics would place this single observation at the mean of long-term results, with each of the periodic returns being described by a conditional lognormal probability density function. (See Appendix 1) When this one change is made, the comparison between the actual historical results and those described by the probability density function improves dramatically, as is shown in the following chart.

Not only is this large company stock return comparison improved, but the same level of improvement is seen if one does a similar comparison with other data sources, such as *SBBI Yearbook* data for stock returns in small companies or for the Dow Jones Industrial Average. The concept of using a conditional probability to match historical data is not only well-grounded based on the underlying mathematics coupled with the source of actual historical data, tests using actual data confirm the improvement.

Actual Data Distribution Compared with Conditional Lognormal Assumption



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> "NOT ONLY IS THE COMPARISON SIGNIFICANTLY IMPROVED, BUT THIS ONE CHANGE HELPS EXPLAIN THE DISASTROUS 401(K) PLAN RESULTS THAT HAVE BEEN SEEN."

FINANCIAL IMPACT

Not only is the comparison significantly improved, but this one change helps explain the disastrous 401(k) plan results that have been seen. This change in density function causes the best estimate rate of a future return to change from an arithmetic mean of historical returns to the lower geometric mean of historical returns. Given that employee participants have been led to believe that they would receive the higher arithmetic mean returns, it is not surprising that they are disappointed with the actual geometric mean results.

In addition, this one conceptual change helps explain some of the turmoil that has been seen recently in the financial services industry. When followed through completely, the concept that historical data is conditional data, not uncorrelated data, helps explain the collapse of Long-Term Capital Management about 15 years ago, and the more recent collapses of Bear Stearns and Lehman Brothers Holdings.

SUMMARY

Actuaries are used to dealing with data. And it is common for them to consider the appropriateness of historical data when using the data to make forecasts. For example, using data from smokers to make estimates of general population mortality is clearly unwarranted. In this article, actuaries are asked to take a second look at investment return data. The data seems to be conditional in nature, and to the extent that it is, treating it as if it is determined independently may also be unwarranted. This one concept could be critical in dealing with the recent financial crises that has created so much concern.

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The formula below is for the traditional lognormal probability density function:

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} \cdot \frac{1}{x} \cdot e^{\frac{-(\ln x - \mu)^2}{2\sigma^2}}$$

The formula below is for the conditional lognormal probability density function given the assumption that the one observed result is at the mean of the expected distribution of long-term investment results:

$$c(x) = \frac{1}{x} \cdot \frac{\sqrt{n}}{\sqrt{n-1}} \cdot \frac{1}{\sigma\sqrt{2\pi}} \, e^{\left[\frac{-n(\ln x - (\mu + \frac{\sigma^2}{2}))^2}{2(n-1)\sigma^2}\right]}$$

THE IMPORTANCE OF MAKING THINGS MORE COMPLEX

By Steve Scoles

One of my favorite *Far Side* cartoons for illustrating man's difficulties in understanding financial markets features a very displeased dog owner chastising his dog over all of the things the dog has done wrong. The dog sits there smiling, loving all of the attention he`s getting as the cartoon shows that all he hears is his name being repeated over and over again.

The key here is that the dog operates at a different level than the human. The dog doesn`t understand English, so trying to explain something to the dog is futile. But this doesn`t stop the owner in the cartoon (and many real-life dog owners) from behaving this way. They can`t or don`t want to see that the dog is operating at a simpler level than them.
When it comes to financial markets, most participants don't see that the market is operating at a more *complex* level than themselves. It's often said that the market is "irrational." However, that kind of comment doesn't recognize the natural behavior of systems that have many interacting parts. These types of systems, called complex systems, are quite common in the natural world and can be useful in getting a better understanding of financial markets.

COMPLEX SYSTEMS AND SAND PILES

Financial markets involve millions of interacting participants who are trying many different strategies. Many natural systems have similar underpinnings—a large number of interacting parts—such as the weather and ecosystems. These types of systems are called complex systems. There is a whole field of science that deals with these systems and finds a number of common features among them.

The first step in understanding complex systems is to look at the simple example of the dynamics of a growing sand pile. Imagine grains of sand being dropped on a flat surface. Gradually the grains build into a small pile. Then a small avalanche or two will happen that broadens the base of the sand pile, allowing an ever larger sand pile to build. At some point, the pile is steep enough that the next grain of sand triggers a massive avalanche.

From the sand pile example, a couple of features of complex systems start to become clear. First of all, cause and effect are very difficult to determine. One grain of sand can start a massive avalanche or it may start no avalanche whatsoever. Rather than one grain of sand causing the avalanche, all of the other grain's interactions leading up to that point put the sand pile into a state such that any additional grain would cause a collapse. The state of the sand pile (e.g., its steepness) matters much more than any incremental grain of sand as far as what comes next.

A second, related, feature is that the sand pile dynamics are very non-linear. The action of an incremental grain can have anywhere from no effect to a large effect. That is, the input and output of the system have no proportional (i.e., linear) relationship. Rather than saying the sand pile avalanche is "irrational," we can see that its dynamics are the natural effect of all of the interacting forces at play.

FINANCIAL MARKETS

To apply the complex systems ideas to financial markets, it's useful to look at another cartoon. In a cartoon by Robert Mankoff from the *New Yorker* in 1981, someone is watching the financial news as the TV anchor says:

> "On Wall Street today, news of lower interest rates sent the stock market up, but then the expectation that these rates would be inflationary sent the stock market down, until the realization that lower rates might stimulate the sluggish economy pushed the market up, before it ultimately went down on fears that an overheated economy would lead to a reimposition of higher interest rates."

CONTINUED ON **PAGE 20**

While this seems quite funny, it's not far off the typical explanation of market movements. For example, here is a quote from Yahoo! Finance on Aug. 7, 2007 on a day when the market gyrated after a Federal Reserve announcement that their benchmark interest rate was left unchanged:

> "Investors were at first deeply disappointed that policy makers … did not provide any hints about a possible cut. But after digesting the policy statement, they quickly gained solace the economy is likely to withstand troubles in the mortgage industry."

Much like the dog-owner talking to a dog at the owner's level, almost all financial market commentary is trying to treat markets at a human level. Rather than realizing the market is a complex system that has non-linear dynamics and where cause and effect are very difficult to link, a story is created to explain what is happening. With so many interacting parts, complex systems are rarely explainable through simple stories.

If creating a suitable story fails, than the default explanation is the market is being "irrational." However, it's not the market that is being "irrational," it's the treating of markets at a human level that is irrational.

MARKET INCREMENTALISM

The typical attempt at explaining market behavior is based on what I call market incrementalism—the widespread, but false, belief that incremental news drives the financial markets.

An impressive example of the error of market incrementalism was the attempt at understanding market moves during the U.S. debt ceiling debate in the summer of 2011. As the deadline neared to raise the ceiling, there was a modest decline in the U.S. stock market. At that point, there were two views being expressed on financial television. The first, most common, view was that the market would fall drastically if the debt ceiling was not raised. The second view, portrayed by a number of market "strategists" was that this was all just political posturing, that the debt ceiling would be raised, and thus this modest market decline was a "buying opportunity."

When the debt ceiling was in fact raised, the U.S. stock market actually declined 15 percent in the next six market sessions! Instead of the U.S. debt debate mattering, perhaps the market fall was just the chaotic after-effects of the steep preceding two-year 100 percent rally in U.S. stock markets. The daily news is simply one of innumerable factors at play with financial markets. Everyday there are good news and bad news stories that can be selected from to explain market moves. In reality, the daily financial market commentary is much more about creating an illusion of understanding and control rather than being useful in helping people succeed in financial markets.

THE GREAT MODERATION

The economy is another complex system. Up until the summer of 2008, it was very common for economists to talk about the "Great Moderation"—a lengthy period of reduced economic volatility due to economists having perfected their craft. (I'm not making this up!)

Recognizing markets and economies as complex systems, provides a much different light on what low volatility might mean. In the sand pile example the lack of volatility (i.e., a steadily growing pile) meant risk was building up. After the pile collapsed, i.e., after a period of extreme volatility, the risk of a further collapse was much lower.

In complex systems, what's happening on the surface can be a very misleading guide to what's happening under the surface. Said another way, in a complex system, the perception of risk and the reality of risk can be very far apart. The Great Moderation was a period when risk was rising. After the Great Moderation ended (and now into the "Great Volatility") is a period of risk being reduced.

> MUCH LIKE THE DOG-OWNER TALKING TO A DOG AT THE OWNER'S LEVEL, ALMOST ALL FINANCIAL MARKET COMMENTARY IS TRYING TO TREAT MARKETS AT A HUMAN LEVEL.

COMPLEX BETTER THAN SIMPLE

I have touched on just some of the ideas of complex systems and how they are a useful framework for understanding financial markets. One of the most valuable ideas is that most financial market commentary is simply not meaningful or not correct in understanding what's happening. Now if only I could find a way to understand my dog better.

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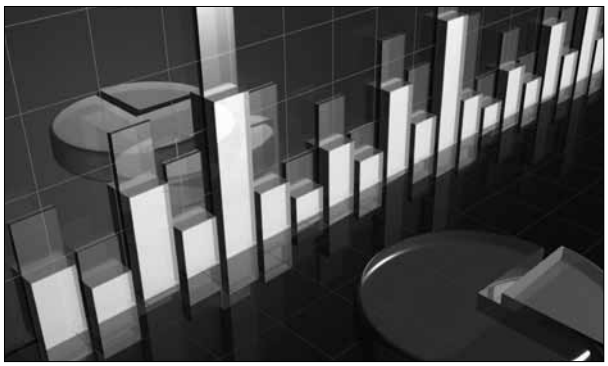

THOSE PESKY ARITHMETIC MEANS (PART 2)

By Richard R. Joss

I wrote an article for the February, 2010, edition of *Risks and Rewards* entitled "Those Pesky Arithmetic Means." The article showed how an arithmetic mean calculation extracted from any given actual investment history can vary significantly just depending upon the fiscal period used for the calculation. To deal with the problem of multiple arithmetic means, the article suggested increasing the number of data points to improve the accuracy of the calculation. But this process, when fully carried out, yields the geometric mean return, which is the rate of actual growth exhibited by the investment. Calculating the arithmetic mean in the more traditional ways by using only a relatively small number of observations of the changes in wealth produces a wide range of arithmetic mean results, all of which must exceed the actual rate of wealth growth for the investment.

In addition to writing the article, I participated in a session about arithmetic means at the most recent Society of Actuaries Annual Meeting. The other participant in the panel discussion was Alex Kane, Professor of Finance at UCSD and a co-author of the widely-used textbook *Essentials of Investments.* During the session I presented the issues outlined above, stressing the conditional nature of historical investment returns. Dr. Kane took a different approach, saying that the best estimate for a geometric return depended upon the investment horizon. A recap of both presentations is to be included in the next issue of *Pension Section News.*

HORIZON-BASED FORECASTS

In his portion of the panel discussion, Dr. Kane offered a very specific formula for the best estimate of a geometric mean. The formula depended upon the length of investment horizon being considered (H) and the length of the history that is used to supply the data for the estimate (T). The specific formula is as follows:

$$E(G_H) = (G_T)x(H/T) + (A_T)x[(T-H)/T]$$

where A_T is an arithmetic mean of historical data and G_T is the geometric mean from the same data set.

As an example of how the formula could be applied, consider the small company stock return data from the *2008 Stocks Bonds Bills and Inflation Yearbook.* This document provides details for an 82-year history of returns, where the calendar-year arithmetic mean is 17.1 percent and the geometric mean is 12.5 percent. For a 10-year investment horizon, the above formula yields 16.5 percent as the best estimate for the geometric return. This specific result is derived as follows:

$$16.5\% = (12.5\%)x(10/82) + (17.1\%)x(72/82)$$

But the same data source shows a sample standard deviation of small company stock returns of about 32.5 percent, and this result when combined with the arithmetic mean of 17.1 percent actually puts limits on the possible range of geometric returns. The chart below shows six different sets of data, each with an arithmetic mean of 17.1 percent and a standard deviation of 32.5 percent. These six different sets of data produce geometric returns that range from 8.1 percent to 14.3 percent.

Comparison of Geometric Average Returns for Sets of 10 Data Elements Each Set Having an Arithmetic Mean of 17.1 percent and a Standard Deviation of 32.5 percent

Year	Set 1	Set 2	Set 3	Set 4	Set 5	Set 6
1	27.4%	86.0%	56.9%	72%	47.9%	108.9%
2	27.4	17.1	56.9	55	47.9	6.9
3	27.4	17.1	56.9	40	47.9	6.9
4	27.4	17.1	17.1	30	47.9	6.9
5	27.4	17.1	17.1	20	47.9	6.9
6	27.4	17.1	17.1	10	-13.7	6.9
7	27.4	17.1	17.1	0	-13.7	6.9
8	27.4	17.1	-22.7	-10	-13.7	6.9
9	27.4	17.1	-22.7	-18	-13.7	6.9
10	-75.4	-51.8	-22.7	-28	-13.7	6.9
Geometric Average	8.1%	12.2%	12.9%	13.0%	13.0%	14.3%

Particular attention should be paid to the first and last columns in the above chart as these results present the absolute minimum and maximum values for a geometric mean for any set of 10 returns that have an arithmetic mean of 17.1 percent and a standard deviation of 32.5 percent. Even though the formula offered a "best estimate" of a geometric return of 16.5 percent, the only way that this result can actually be obtained is if in the future, the arithmetic average of small stock returns exceeds its historical average or the standard deviation of small stock returns falls short of its historical average.

SUMMARY

Actuaries working with pension plans face a difficult challenge when choosing an investment return assumption to use for valuation purposes. At the time this article is being written, there is an Exposure Draft of an Amendment to Actuarial Standard of Practice No. 27, Selection of Economic Assumptions for Measuring Pension Obligations, which specifically references arithmetic means as a possible basis for assumption selection. During the panel discussion both panelists encouraged that the Exposure Draft not be adopted. As shown above, historical arithmetic means may significantly overstate true expected returns, unless the future returns exhibit significantly different characteristics than that particular type of investment exhibited in the past.

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