

Introduction

This research bulletin is the first in a series covering various aspects of stress testing and scenario analysis. In this paper, we compare and contrast two historical scenarios that may be of current interest given the increasing uncertainty regarding the returns on sovereign fixed income investments. The scenarios we consider here are the 1998 Russian debt crisis and the 1994 US rate hike that followed the savings and loan (S&L) crisis. We put a stylized US pension plan through the stress tests using BarraOne, a risk platform that provides more than 60 preloaded historical scenarios from the 1970s to the present. Each scenario that we consider applies shocks to global market factors for equities, interest rates, credit spreads, FX rates, and commodities. We review the effect of the scenarios on the pension plan, and we discuss possible hedges.

Selecting Relevant Historical Scenarios

The goal of this exercise is to reflect on today's environment of increasing uncertainty about the returns of sovereign fixed income portfolios. Investors are faced with the prospect of widespread fiscal deficits and further increases in government debt in most advanced economies for years to come. This leads to two major concerns for investors in sovereign debt.

The first concern is the return of capital, which is threatened by debt defaults. Worries about the inability to refinance short- to mid-term debt, and worries about the possible failure to service this debt, have recently driven spreads and volatilities in European sovereign debt markets to historically high levels.

If we look for an historical parallel for a sovereign default, we find that the Russian financial crisis in 1998 led to a sovereign debt default in an environment of structural Russian budget deficits and unexpectedly adverse economic conditions following the 1997 Asian crisis. Hence, we investigate portfolio behavior under a "1998 Russian Financial Crisis" scenario.

A second concern for many investors is the return on their allocated capital from so-called "safe haven" government bonds, especially US Treasuries. Unprecedented expansionary fiscal policy has provided a great stimulus for the US economy. While GDP increased by +5.9% year-on-year in Q4 2009, unemployment stayed at 9.7% throughout Q1 2010, which raises questions about the nature of the recovery.

If we look for an historical parallel for this environment, we find that the current environment of low US interest rates, increasing GDP and high unemployment, is similar to the recovery following the 1990-1991 recession, the first of the so-called "jobless recoveries." The S&L crisis had required a massive financial bailout supported by very accommodating liquidity conditions. After that crisis had abated in 1994, interest rates increased from 3% to 6% in a period of 11 months, as the Federal Reserve decided to withdraw the extra liquidity. To understand the implications of withdrawing liquidity, we investigate portfolio behavior under a "1994 US Rate Hike" scenario.

Stress Test Results for a US Pension Plan

We analyze the impact of the two selected scenarios on a portfolio with asset class allocations close to the average of public pension funds in the US. Exhibit 1 shows the performance of the components of the portfolio using the stress testing capabilities of BarraOne¹. Gains or losses correspond to those that occurred through the periods in review, eleven months for the 1994 crisis and one month for the 1998 crisis. All simulated P&L figures reflect today's portfolio exposure to market factors and the historical performance of those market factors.

Exhibit 1: Impact of the two historical scenarios from 1994 and 1998 on a US pension plan. Analysis date is 31 Dec. 2009.

Asset Class	Index	Initial Allocation*	1998 Russian Financial Crisis	1994 US Rate Hike
			P&L	P&L
Global Equity		56.9%	-5.7%	-7.4%
US Equity	MSCI USA IMI**	38.1%	-3.5%	-5.5%
Intl Equity	MSCI ACWI IMI** ex USA	18.8%	-10.4%	-11.1%
Global Fixed Income		27.6%	1.9%	-9.4%
US Fixed Income	Citi US Broad Investment Grade	26.7%	1.8%	-9.4%
Intl Fixed Income	Citi World Government 10 ex USA	0.9%	6.0%	-8.6%
Real Estate**	MSCI US Real Estate IMI**	8.7%	-4.4%	-9.4%
Hedge Funds	Credit Suisse Tremont Hedge	6.8%	-9.7%	-5.4%
TOTAL		100.0%	-3.8%	-8.0%

* The average allocation is based on the Wilshire 2009 State Retirement Funding report, except we distributed the 5.6% private equity allocation equally to Real Estate and Hedge Funds, the other alternative asset classes.

** IMI=Investable Market Index; includes Large, Mid and Small cap segments; ACWI=All Country World Index

*** Real estate is proxied by real estate equities; the focus of the analysis is on global equity and fixed income.

The return of the portfolio for the 1994 scenario is -8.0%, which would correspond to the 93rd percentile of historical losses for a 60/40 US portfolio for the period 1970 to 2010. This loss is milder than the typical -20% pension plan loss in 2008, but it highlights the sensitivity of diversified portfolios to a rise in interest rates. The losses for the 1998 scenario are more benign, with a return of -3.8%.

The effect of the two episodes on the main portfolio components is straightforward: big losses in the 1994 scenario in fixed income (-9.4%), and a decline in equity markets (-7.4%) on fears of slower economic growth. In the 1998 scenario, losses in all risky asset classes, in particular international equity (-9.4%) and to a lesser extent in US equity (-3.5%), combined with a flight to quality that lifted returns from US government bond holdings (+1.8%).

Since many pension plans manage their assets against their liabilities (ALM), we show the asset-liability view of the same stress tests in Exhibit 2. The 1998 scenario has a direct negative impact on the funding ratio, going from 100% to 98.5%. In the 1994 scenario, the interest rate hike significantly reduces the value of the long duration liabilities, hence resulting in a funding ratio of 109.4%.

¹ The complete stress testing methodology can be found in the *BarraOne Analytics Guide* (2010).

Exhibit 2: ALM-impact of two historical stress tests 1994 and 1998, on a stylized US pension plan

	Initial Value	1998 Russian Financial Crisis	1994 US Rate Hike
Assets	100.00	-3.8%	-8.0%
Liabilities*	100.00	-1.8%	-15.9%
Funding ratio	100.0%	98.0%	109.4%

*Liabilities are proxied with the long-duration bonds of the Merrill Lynch US Corporate Bond Index. Only bonds that have durations longer than 10 are retained; the resulting proxy liability index has duration of 12.7.

Two Future Interest Rate Scenarios — A Closer Look

These results prompt a closer look at the situation for interest rates, which critically link the performance of pension plan assets and liabilities. In the US, the last 30 years have seen a decline in interest rates, from a high of 18.6% in 1980 to the current rate of close to 0% for the short side of the curve, and from 12.8% to the current 4% for 10-year yields. This period corresponds to one of the longest bull market runs for long-dated fixed income instruments, returning 9% on average over the period.

Exhibit 3: Two possible scenarios for the US yield curve

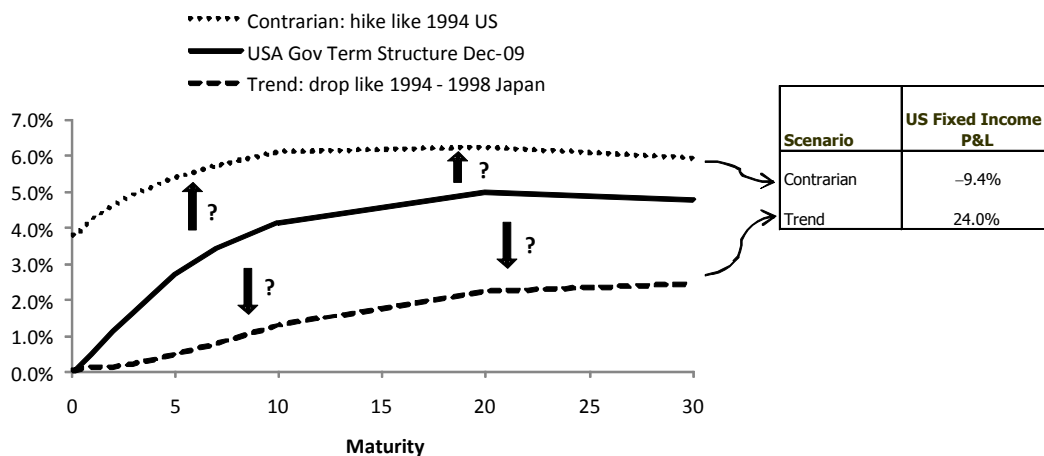


Exhibit 3 shows the current US term structure as well as a trend and a contrarian scenario. Given the length of the period of declining interest rates, behavioral finance would point to a consensus scenario that extrapolates the long term historical trend of declining yields. This scenario projects the US into the situation of Japan after the collapse of the real estate and equity market bubble in the 1980s. In a Japan-like deflation scenario, US interest rates would decline in an environment of limited growth, following a failure to jump-start the economy with current fiscal policy. Our scenario is determined by applying the change to the Japan term structure from Q1 1994 - Q3 1998 to the current US term structure. Over the period, Japan interest rates fell from levels close to those currently seen in the US to levels shown in the trend line in Exhibit 3. Note that Japan interest rates in Q3 1998 are also very similar to those of Japan today.

The contrarian scenario resembles the 1994 US rate hike. This scenario would incorporate a higher level of inflation, at around 4%. This moderate increase could reflect structural changes, such as the lenient policy targets defended in a recent IMF study (Blanchard et al. (2010)), or it could reflect traditional inflationary pressures, for example, from a weaker dollar following a revaluation of the Chinese Yuan and higher prices for Chinese imports. Real rates on long-dated instruments are close to 1% today. If they revert to their long-term average of 2% as calculated in Dimson et al. (2009), the nominal yield on long-term bonds would be close to 6%; this is the approximate level of our contrarian interest rate scenario.

As shown before, the contrarian scenario for interest rates produces a loss of -9.4% for the US fixed income part of the plan portfolio. The trend scenario for interest rates produces a P&L of +24.0%, illustrating the ample leeway for long-term bonds to increase in value with further decrease of interest yields. It also increases considerably the value of pension liabilities and result in a decreased funding ratio, the opposite results of the 1994 scenario previously discussed.

Tactical Hedges for an Interest Rate Hike

Given the risk that sovereign bonds will no longer be the safe havens they once were, it is useful to investigate possible ways to mitigate the losses in the context of an increase in interest rates across the curve. In this section, we are interested in understanding directionally two tactical hedge options for US fixed income at the plan level: substituting the bond allocation with short duration bonds, or substituting the bond allocation with TIPS. The results are shown in Exhibit 4.

Exhibit 4: Impact of a historical 1994 scenario on alternative asset allocations

				1994 US Rate Hike	
	Asset Class	Index	Duration	Asset Class P&L	Pension Plan** P&L
Initial	US Fixed Income	Citi US Broad Investment Grade	4.2	-9.4%	-8.0%
Option 1*	T-bills	Merrill Lynch US Treasury Bills 0-3 months	0.1	2.0%	-4.9%
Option 2*	TIPS	Merrill Lynch US Treasury Inflation-Linked	7.6	-6.9%	-7.3%

*Hedge by substituting US Fixed Income fully by the other instrument.

**Using average asset class allocation based on the Wilshire 2009 State Retirement Funding report.

The first alternative we evaluate is to reduce the duration of the bond portfolio, which we illustrate with a full swap of the US bond portfolio for T-bills. By shortening duration, the nominal loss for US fixed income can be turned into a nominal gain of 2%². At the plan level, the loss would have been reduced from -8.0% to -4.9%. Note that this hedge option would reduce the matching of the long-duration liabilities in the ALM view, and further aspects of this strategy would need to be considered by plan managers.

The second option we analyze is to replace the bond portfolio with an allocation to US Treasury inflation-protected bonds (TIPS). Allocations to TIPS have risen in importance over the last few years due to their potential to hedge liabilities and inflation risk. Unfortunately, TIPS have a relatively short history; the first TIPS were issued in 1998.

² Note that the return to T-bills would be obtained by rolling into new T-bills during the scenario period. The T-bill investment would closely track the increase in nominal interest rates and realize half of the increase in nominal rates as investment return, in this case about 2%.

For the purpose of scenario analysis, we need to make some modeling assumptions³. We assume, supported by recent historical TIPS data, that an increase in nominal interest rates is attributed 50% to an increase in real rates and 50% to an increase in inflationary expectations. Under this assumption, the real term structure shock would have resulted in a loss for TIPS of -6.9%. This is a smaller loss than the loss for nominal bonds. However, given the larger duration of the TIPS benchmark in this example, the loss is still high compared to the T-bill hedge.

Conclusion

Today's investors in sovereign debt are faced with two critical questions: 1) what level of real risk premium should they require for a given sovereign bond? and 2) what is their prediction on the course of future inflation? The two scenarios that we reviewed in this bulletin shed light on the risk and reward tradeoffs at the plan level and possible hedging strategies. We showed how the 1994 stress test results in a significant loss in US fixed income that overshadows most asset class losses from an event like the 1998 Russian debt default. The 1994 result is less severe when looking at assets and liabilities together, with an increase in funding ratio.

However, historical parallels have limitations. No historical situation is exactly the same as a current situation, and of course past performance is no guarantee of similar future performance. The sovereign default threat of today is more toward the center of the financial system, whereas in 1998 the sovereign default happened more at its periphery. Therefore, a more realistic scenario might combine elements of both scenarios, resulting in a more severe stress test with large losses across all asset classes.

Our approach to stress testing emphasizes the choice of relevant forward-looking scenarios which can be proxied easily, either with predefined historical scenarios or with specific scenarios designed to fit current circumstances. While the latter approach is more appealing conceptually, it is not straightforward in practice. In particular, the specific behavior of assets during crises needs to be taken into account. Models need to incorporate tail risk and the changing nature of correlations. While tools like Barra Extreme Risk (BxR) are available today to incorporate extreme risk in simulations, more research remains to be done before we can incorporate stressed correlations in a coherent way into a covariance matrix. We will have more on this topic in a future research bulletin.

References

MSCI Barra (2010), "BarraOne Analytics Guide."

Blanchard et al., "Rethinking Macroeconomic Policy," IMF, February 2010.

Elroy Dimson, Paul Marsh, and Mike Staunton, "Credit Suisse Global Investment Returns Yearbook 2009."

³ To model the real term structure, we use the covariance between term structure risk factors for the nominal and real term structure from the Barra Integrated Model for December 2008 till March 2010 to calculate an average beta between the nominal and real term structure shift factor. Using this average beta of 0.5, we determine a shift in the real term structure, based on the change in the nominal term structure.

Contact Information

clientservice@mscibarra.com

Americas

Americas	1.888.588.4567 (toll free)
Atlanta	+ 1.404.551.3212
Boston	+ 1.617.532.0920
Chicago	+ 1.312.675.0545
Montreal	+ 1.514.847.7506
Monterrey	+ 52.81.1253.4020
New York	+ 1.212.804.3901
San Francisco	+ 1.415.836.8800
Sao Paulo	+ 55.11.3706.1360
Stamford	+1.203.325.5630
Toronto	+ 1.416.628.1007

Europe, Middle East & Africa

Amsterdam	+ 31.20.462.1382
Cape Town	+ 27.21.673.0100
Frankfurt	+ 49.69.133.859.00
Geneva	+ 41.22.817.9777
London	+ 44.20.7618.2222
Madrid	+ 34.91.700.7275
Milan	+ 39.02.5849.0415
Paris	0800.91.59.17 (toll free)
Zurich	+ 41.44.220.9300

Asia Pacific

China North	10800.852.1032 (toll free)
China South	10800.152.1032 (toll free)
Hong Kong	+ 852.2844.9333
Seoul	+ 827.0768.88984
Singapore	800.852.3749 (toll free)
Sydney	+ 61.2.9033.9333
Tokyo	+ 81.3.5226.8222

www.mscibarra.com

Notice and Disclaimer

- This document and all of the information contained in it, including without limitation all text, data, graphs, charts (collectively, the "Information") is the property of MSCI Inc. ("MSCI"), Barra, Inc. ("Barra"), or their affiliates (including without limitation Financial Engineering Associates, Inc.) (alone or with one or more of them, "MSCI Barra"), or their direct or indirect suppliers or any third party involved in the making or compiling of the Information (collectively, the "MSCI Barra Parties"), as applicable, and is provided for informational purposes only. The Information may not be reproduced or redisseminated in whole or in part without prior written permission from MSCI or Barra, as applicable.
- The Information may not be used to verify or correct other data, to create indices, risk models or analytics, or in connection with issuing, offering, sponsoring, managing or marketing any securities, portfolios, financial products or other investment vehicles based on, linked to, tracking or otherwise derived from any MSCI or Barra product or data.
- **Historical data and analysis should not be taken as an indication or guarantee of any future performance, analysis, forecast or prediction.**
- **None of the Information constitutes an offer to sell (or a solicitation of an offer to buy), or a promotion or recommendation of, any security, financial product or other investment vehicle or any trading strategy, and none of the MSCI Barra Parties endorses, approves or otherwise expresses any opinion regarding any issuer, securities, financial products or instruments or trading strategies. None of the Information, MSCI Barra indices, models or other products or services is intended to constitute investment advice or a recommendation to make (or refrain from making) any kind of investment decision and may not be relied on as such.**
- The user of the Information assumes the entire risk of any use it may make or permit to be made of the Information.
- NONE OF THE MSCI BARRA PARTIES MAKES ANY EXPRESS OR IMPLIED WARRANTIES OR REPRESENTATIONS WITH RESPECT TO THE INFORMATION (OR THE RESULTS TO BE OBTAINED BY THE USE THEREOF), AND TO THE MAXIMUM EXTENT PERMITTED BY LAW, MSCI AND BARRA, EACH ON THEIR BEHALF AND ON THE BEHALF OF EACH MSCI BARRA PARTY, HEREBY EXPRESSLY DISCLAIMS ALL IMPLIED WARRANTIES (INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF ORIGINALITY, ACCURACY, TIMELINESS, NON-INFRINGEMENT, COMPLETENESS, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE) WITH RESPECT TO ANY OF THE INFORMATION.
- Without limiting any of the foregoing and to the maximum extent permitted by law, in no event shall any of the MSCI Barra Parties have any liability regarding any of the Information for any direct, indirect, special, punitive, consequential (including lost profits) or any other damages even if notified of the possibility of such damages. The foregoing shall not exclude or limit any liability that may not by applicable law be excluded or limited, including without limitation (as applicable), any liability for death or personal injury to the extent that such injury results from the negligence or wilful default of itself, its servants, agents or subcontractors.
- Any use of or access to products, services or information of MSCI or Barra or their subsidiaries requires a license from MSCI or Barra, or their subsidiaries, as applicable. MSCI, Barra, MSCI Barra, EAFE, Aegis, Cosmos, BarraOne, and all other MSCI and Barra product names are the trademarks, registered trademarks, or service marks of MSCI, Barra or their affiliates, in the United States and other jurisdictions. The Global Industry Classification Standard (GICS) was developed by and is the exclusive property of MSCI and Standard & Poor's. "Global Industry Classification Standard (GICS)" is a service mark of MSCI and Standard & Poor's.

© 2010 MSCI Barra. All rights reserved.

About MSCI Barra

MSCI Barra is a leading provider of investment decision support tools to investment institutions worldwide. MSCI Barra products include indices and portfolio risk and performance analytics for use in managing equity, fixed income and multi-asset class portfolios.

The company's flagship products are the MSCI International Equity Indices, which include over 120,000 indices calculated daily across more than 70 countries, and the Barra risk models and portfolio analytics, which cover 59 equity and 48 fixed income markets. MSCI Barra is headquartered in New York, with research and commercial offices around the world.