Market Insight

Stress Scenarios for Japanese Government Bond Yields: Insights from the Barra Integrated Model

Second in a Series of Three Reports on Stress Testing for Rising Government Bond Yields in Japan

Oleg Ruban
Oleg.Ruban@msci.com

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Abstract:

This paper, the second in a series of three, examines the potential impact of rising Japanese Government Bond yields on a range of sample portfolios. We create scenarios that model market conditions associated with a rise in yields using factors in the Barra Integrated Model. A key insight is that the underlying cause of the rise in yields matters greatly for the spillover effects associated with the scenario. In particular, the different stories behind the rise in yields have different implications for the correlation between Japanese equities and government bonds. This correlation is crucial in determining the size and direction of the impact of these scenarios on representative portfolios in different geographical segments and asset classes.

Why This Matters:

- In recent months, our clients have expressed concerns about the possibility of JGB yields rising rapidly and the impact of this rise on their portfolios.
- Turmoil in the JGB market may have significant impact on the Japanese, Asia-Pacific and Global bond and equity markets.
- Investors need a robust multi-asset class risk model to analyze the implications of rising JGB yields on their portfolios. We show that due to the interconnectedness of markets, the consequences of rising JGB yields may be significant even for investors who do not hold JGBs.

Introduction

In our introductory Market Insight, *Analyzing the Current Risks in the Japanese Government Bond Market,* we reviewed the arguments that Japanese Government Bond yields may rise significantly from their current levels. This paper uses the factors in the Barra Integrated Model (BIM) to construct scenarios that model the market conditions associated with the rise in yields. As we noted in our introductory paper, the potential rise in yields may be realized over the course of a few months (such as the VaR shock of 2003) or a few years. To account for the different horizons, we use two versions of the Barra Integrated Model: a more responsive daily model with a 51 day half life and the long-term version of the Barra Integrated Model (BIM301L).

We construct the following stress tests:

1. A non-parallel rise in the Japanese government bond yields, leading to movements in other model factors due to correlations. At the time of writing, the model's forecast correlation between JGBs and Japanese equities is negative, meaning a rise in JGB yields results in a positive return to Japanese equities. Historically, this pattern was observed during the VaR shock of 2003. The negative correlation between bonds and equities would also be consistent with a positive macroeconomic scenario where Abenomics succeeds in boosting both growth and inflation.
2. In an alternative scenario, the correlation between JGBs and Japanese equities is positive, meaning that a rise in yields would result in a negative return to Japanese equities. This scenario is consistent with a rise in yields occurring amid a negative market outlook for Japanese growth.

We illustrate the impact of these two scenarios on a range of representative portfolios in Japan and abroad.

Using the Barra Integrated Model

In this paper, we use the Barra Integrated Model to implement the stress tests. In the third paper in our series, we will focus on implementing the stress tests using RiskManager.

The Barra Integrated Model is a multi-layered, multi-asset class model that combines local market detail with global market integration. It can be broadly described as a factor model of factor models. At the most detailed level, its building blocks are factor models for each asset class and each market (i.e., Japanese equities, Japanese fixed income, US equities, Commodities, Hedge Funds, and so forth). It then uses coarser sets of global and core factors to model factor co-movements across different countries and different asset classes. For more details on BIM 301, please see Shepard (2011).

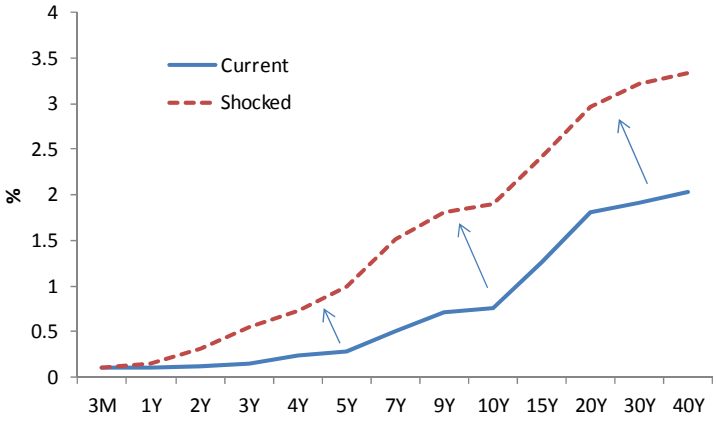
Scenario Analysis

Rising JGB Yields

Impact on Japanese Government Bonds

First, we consider a non-parallel rise in JGB yields, mimicking the yield movements seen during the VaR shock of June-September 2003 (see Figure 1). For clarity, we will refer to this scenario as the *yield shock* going forward.

Figure 1: Non-parallel Rise in JGB Yields.



Source: MSCI

Table 1 examines the impact of this hypothetical scenario on bonds in the Nomura BPI JGB Index, grouped by maturity. In this scenario, the overall portfolio loses approximately 7 percent in this case. The yield shock results in milder losses in the shorter maturity buckets and greater losses in the longer maturity buckets.

Table 1: Impact of the Yield Shock on the Nomura BPI JGB Index. (as of August 28, 2013).

Maturity	Loss
0 to 3Y	-0.41%
3 to 5Y	-2.02%
5 to 7Y	-4.70%
7 to 10Y	-8.22%
> 10 Y	-15.78%
Overall portfolio	-7.19%

Source: MSCI; Barra Integrated Model

Impact on Japanese Corporate Bonds

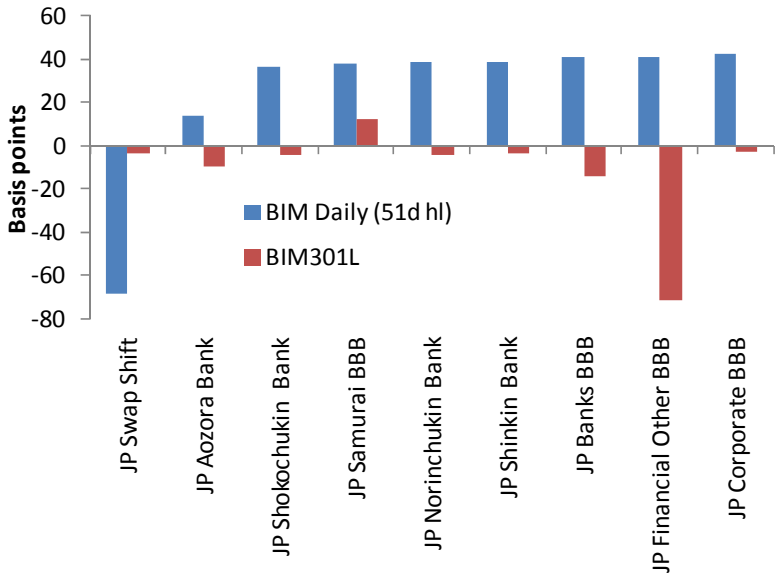
Next, we consider the impact on corporate bonds under this scenario. In addition to the risk coming from the government bond curve, corporate bonds are exposed to risk coming from credit spreads. The correlation between government bond yields and credit spreads for various sectors becomes an important driver of the impact of the stress scenario.

Figure 2 shows the expected returns of a selection of credit spread factors as the result of the yield shock (as defined in the previous section). We see that the correlation between credit spreads and government bond yields can depend on the responsiveness of the risk model. At the time of writing, a more responsive model with a 51-day half life is predicting a widening of some corporate spreads, while a model that looks back at a longer history suggests that corporate spreads will narrow as government bond yields rise.

Fundamentally, these two effects are consistent with different views of the drivers of the stress test. If the government bond yields rise as a result of a more positive economic outlook, corporate bond spreads may be expected to narrow, as risk of distress falls. However, if the widening of JGB yields is associated with concerns about bank balance sheets, credit spreads for financial companies may be expected to widen.

Table 2 shows the impact of the yield shock on the Nomura BPI Corporate Bond index, grouped by rating and sector. The different response of corporate spreads results in a return difference of 36 basis points at the portfolio level and 57 basis points for the Financials sector.[1]

Figure 2: Impact of the Yield Shock on Credit Spreads (as of August 28, 2013).



Source: MSCI; Barra Integrated Model

[1] It may surprise the reader that the differences in portfolio outcomes are relatively minor, despite the different patterns in corporate spread movements seen in Figure 2. This is due, in large part, to the expected movement of the Japanese swap spread. The tightening of the swap spread in the more responsive model partially offsets the widening in corporate bond spreads.

Table 2: Impact of the Yield Shockon the Nomura BPI Corporate Index (as of August 28, 2013).

	BIM 301L	BIM Daily (51d hl)
by rating		
AAA	-2.59%	-2.20%
AA	-5.06%	-5.61%
A	-2.50%	-2.66%
BBB	-2.78%	-2.86%
BB	-5.87%	-5.94%
by sector		
Consumer Discretionary	-2.18%	-2.25%
Consumer Staples	-2.68%	-2.71%
Energy	-1.43%	-1.33%
Financials	-4.21%	-4.78%
Industrials	-5.32%	-5.74%
Information Technology	-1.22%	-1.27%
Materials	-2.37%	-2.17%
Others	-4.22%	-4.62%
Telecommunication Services	-3.19%	-3.41%
Utilities	-2.67%	-2.81%
Total portfolio	-3.93%	-4.29%

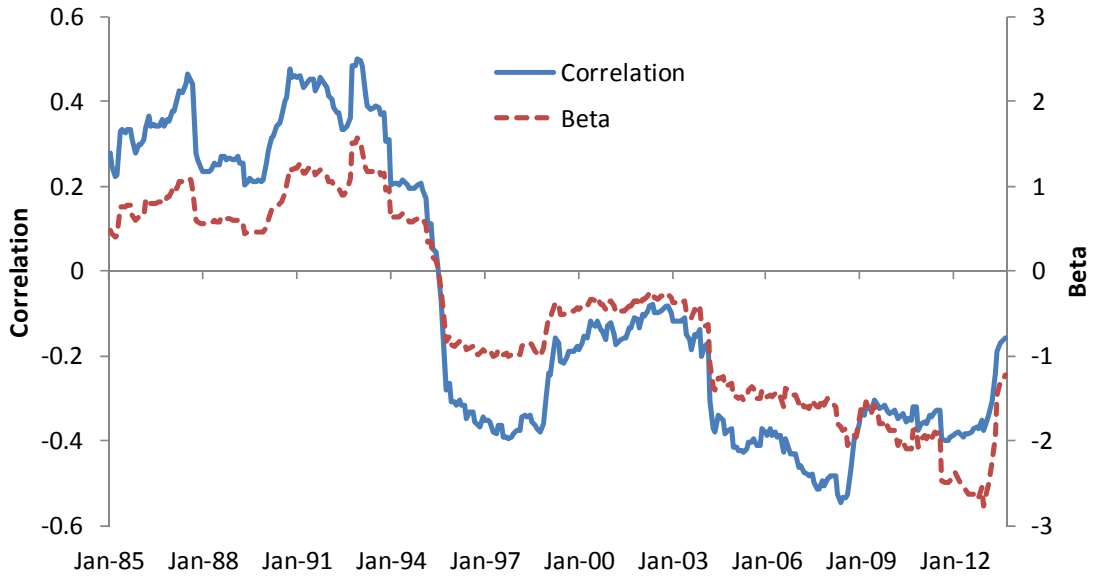
Source: MSCI; Barra Integrated Model

Response of Japanese Equities

Equities are impacted by the stress scenario through the correlations of equity factors with the fixed income factors. Consistent with most developed markets, the realized correlation between government bonds and equities in Japan has been negative in recent years (see Figure 3). The forecast correlation of BIM301L is also negative; hence the model predicts that equities react positively to a rise in JGB yields. Fundamentally, this is consistent with a rise in yields caused by a positive growth and inflation outlook in Japan. This result is also consistent with the most recent historical experience of sharp yield rises: during the VaR shock of 2003, the MSCI Japan IMI portfolio rallied approximately 20 percent.

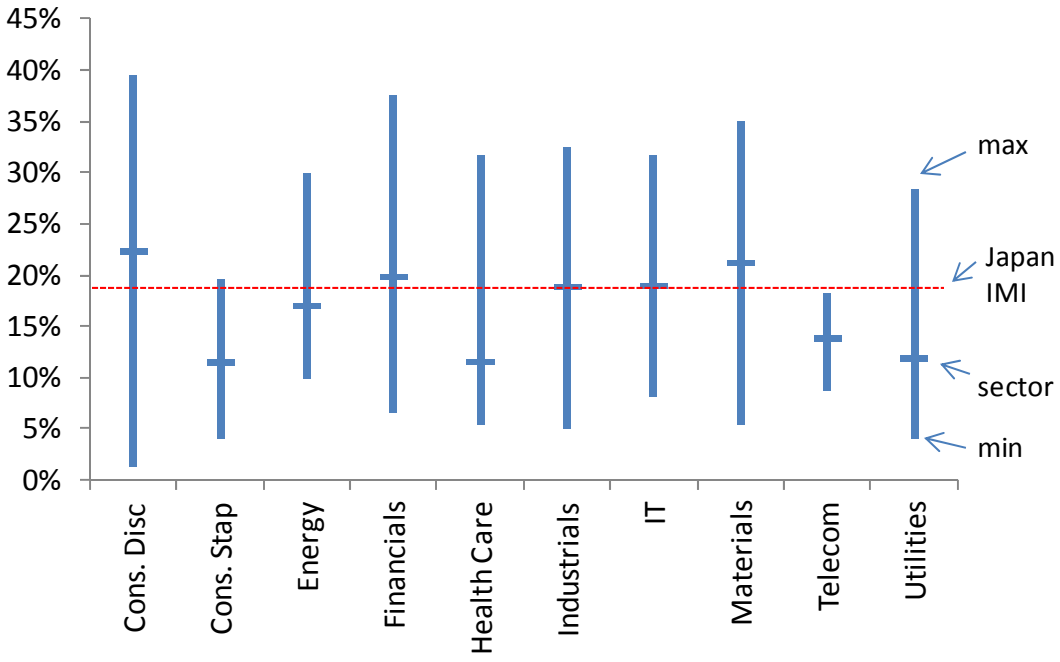
The predictive impact of the yield shock on equities (using the long term version of the Barra Integrated Model) is illustrated in Figure 4. The MSCI Japan IMI portfolio is expected to gain 19 percent in this scenario, with Financial and Materials among the best performing sectors (gaining 20 and 21 percent, respectively), while Healthcare and Utilities are among the worst (gaining 11 and 12 percent, respectively).

Figure 3: Realized Correlation Between Government Bonds and Equities in Japan (60m rolling).



Source: MSCI, OECD

Figure 4: Response by Sector of the MSCI Japan IMI Portfolio to the Yield Shock. (as of August 28, 2013).



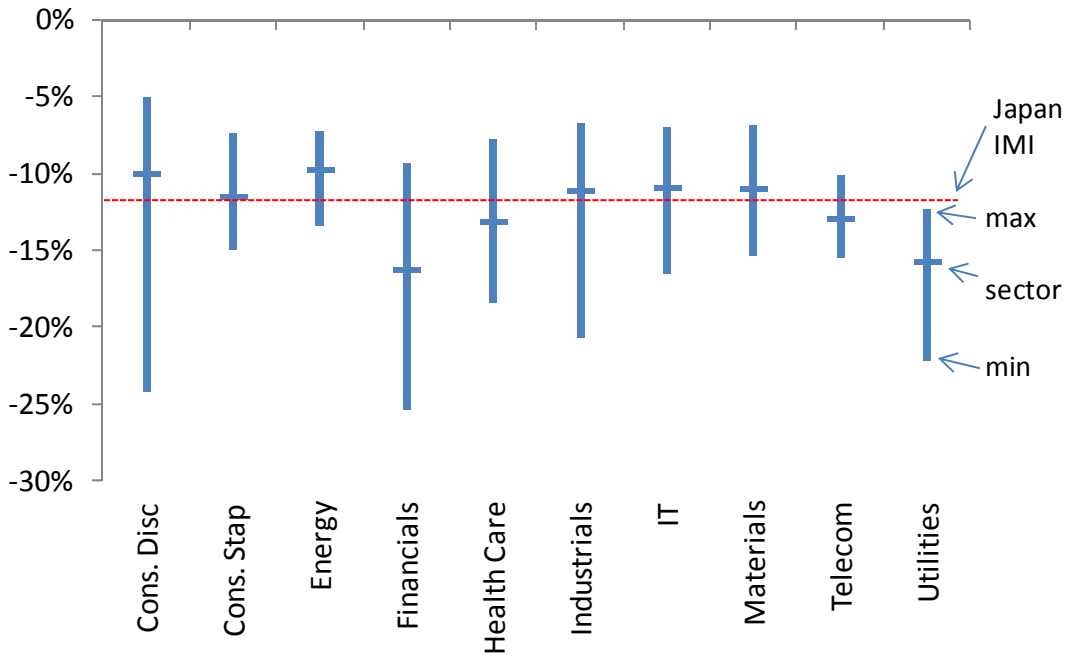
Source: MSCI, Barra Integrated Model (BIM301L)

Altering the Response of the Japanese Equity Market

As we discussed in our introductory paper (Ruban [2013]), it is possible for a rise in JGB yields to have a negative impact on equity markets, if rising yields are not associated with an improving outlook for Japan's economic growth. Quantitatively, while in recent years the correlation of government bond and equity returns in Japan has been negative, Figure 3 shows that this was not always the case. Hence, it is also interesting to consider what happens when we combine a rise in yields with a negative shock to equities.

Given the historical evolution of volatilities and correlations, it is reasonable to propose a beta of 1.6 of equities to bonds, leading to a loss of approximately 12 percent in the Japanese equity market if the JGB market loses 7.25 percent.[2] We can use this result to create an alternative scenario. Specifically, we supplement the interest rate movements described by the yield shock in Table 1 with a loss of 12% to the carve-out of the BIM estimation universe corresponding to the broad portfolio of Japanese equities and apply the two shocks as a correlated stress test. Using this alternative scenario, we see that Financials and Utilities are predicted to bear the greatest losses (both losing about 16 percent), while Consumer Discretionary sector fares the best (losing 10 percent).

Figure 5: Response by Sector of the MSCI Japan IMI Portfolio to the Yield Shock coupled with a Broad Equity Market Decline.
(as of August 28, 2013).



Source: MSCI, Barra Integrated Model (BIM301L)

[2] We note from Figure 3 that the beta of Japanese equities to government bonds reached a high of 1.6 at the end of 1992. The loss of 7.25% in the JGB market comes from the application of the yield shock to the Nomura BPI JGB Index in Table 1.

Impact on Currency, Global Bond and Global Equity Markets

Finally, we can look at the implications of our scenarios on global bond, equity and currency market movements. Given that the JGB market accounts for almost one third of all government debt outstanding, it is important for investors to consider the magnitude and direction of spillover effects.

Table 3 considers the impact of the scenarios on a range of portfolios representing the cross-section of global markets. While the impact on portfolios varies by country, several broad conclusions stand out. For example, the impact of the scenarios can differ widely, depending on whether the rise in yields coincides with a domestic equity market rally or correction. A more responsive model that relies on more recent correlations to a greater extent, tends to suggest more severe losses on the downside, while a less responsive model predicts greater gains on the upside.

Examining the market movements highlighted in Table 3, we see that the impact of the scenarios on currency markets is relatively muted. Even with a relatively steep rise in yields, the model suggests that the yen is likely to remain within $\pm$10 percent of its current levels. Equity market impact, on the other hand, is more pronounced and varies considerably, depending on whether the stress scenario implies losses or gains in Japanese equities. If Japanese equities rally, for example, the ACWI IMI could gain up to 20 percent, while If Japanese equities decline, the index could lose almost 7 percent. The potential for equity losses in some Asian Emerging Markets, as a result of contagion from Japan, is quite severe—Indonesia, Philippines and Taiwan could experience some of the most severe losses. The Barra Integrated Model also suggests that government bond markets outside of Japan may be expected to rally, if the rise in JGB yields is coupled with a Japanese equity market rally. On the other hand, if Japanese equities decline as JGB yields rise, then worldwide government bond markets may be expected to see losses. Given the size of the JGB market, the latter outcome is consistent with a broad loss of investor confidence in government bonds.

Conclusion

Due to the size of the JGB market, potential stress scenarios that simulate the rise of JGB yields can have wide-ranging implications for financial markets in Japan, the Asia-Pacific Region, and worldwide. In this paper, we show how to create hypothetical scenarios that model market conditions associated with a rise in yields using factors in the Barra Integrated Model.

Our results suggest that the implications of rising JGB yields depend greatly on the underlying cause. The reasons why yields may potentially rise can range from benign economic scenarios, where Abenomics succeeds, to less favorable scenarios where yields rise due to a decline in domestic savings and continuing concerns over the fiscal situation in Japan. The different stories behind the rise in yields have different implications for the correlation between Japanese equities and government bonds. This correlation is crucial in determining the size and direction of the impact of these scenarios on investor portfolios. At the time of writing, the BIM301L model suggests that, based on recent correlations, Japanese equities would react positively to a rise in JGB yields.

Finally, we show that the scenarios of rising yields in Japan may also have implications for global investors, who do not hold JGBs. In particular, the potential for equity losses in some Asian Emerging Markets, as a result of contagion from Japan, could be quite severe.

Appendix:

Table 3: Impact on JGB Stress Scenarios on Currencies, Global Equities and Global Bonds (in JPY terms).

	301L		BIM Daily (51d hl)	
	Yield rise	Yield rise + equity fall	Yield rise	Yield rise + equity fall
Currencies				
AUDJPY	9.420%	-4.547%	7.563%	1.398%
GBPJPY	9.765%	0.881%	2.784%	-3.477%
EURJPY	6.809%	-2.385%	4.835%	-3.029%
CHFJPY	3.167%	-4.582%	0.747%	-6.155%
USDJPY	8.940%	0.968%	3.743%	-4.523%
Equities				
ACWI IMI	18.749%	-1.550%	6.338%	-6.844%
USA	18.540%	0.272%	4.099%	-5.922%
DEU	20.520%	-0.730%	7.417%	-3.719%
AUS	17.961%	-5.716%	12.001%	-1.814%
CHX	23.746%	2.433%	2.773%	-14.415%
KOR	22.155%	-2.698%	1.723%	-15.458%
TWN	16.018%	-2.643%	-4.351%	-21.215%
HKG	20.884%	0.600%	3.616%	-13.241%
ZAF	16.165%	-6.530%	2.087%	-10.733%
SGP	17.209%	-2.526%	1.491%	-11.783%
IND	16.983%	-4.334%	6.150%	-7.833%
MEX	16.334%	-8.332%	0.428%	-14.612%
MYS	17.088%	1.878%	4.316%	-10.912%
THA	14.175%	-6.281%	-0.222%	-20.636%
IDN	14.655%	-5.387%	-5.540%	-26.724%
PHL	16.609%	-3.028%	-1.214%	-23.109%
Global Government Bonds				
SSB WGB Index	-0.137%	-5.935%	-0.572%	-6.169%
USA	3.935%	-2.864%	2.018%	-5.562%
ITA	3.395%	-6.449%	4.694%	-4.506%
DEU	1.257%	-6.638%	2.251%	-5.223%
GBR	0.535%	-6.464%	-3.192%	-8.985%
CAN	5.887%	-4.052%	1.261%	-5.809%
AUS	2.982%	-8.199%	4.067%	-1.787%
MEX	8.265%	-7.984%	5.372%	-5.890%
ZAF	4.246%	-11.317%	1.024%	-9.347%

Source: MSCI; Barra Integrated Model

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Shepard, P. (2011) The Barra Integrated Model (BIM301) Research Notes, MSCI Model Insight.

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[1] *As of September 30, 2012, as published by eVestment, Lipper and Bloomberg on January 31, 2013*

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