

# Is Your Portfolio Positioned for Shifts in Risk Aversion?

## Barra Investment Insight: Using Barra Models to Understand the Investment Environment

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### **What's your portfolio's view on risk aversion?**

This article examines how stock exposures to the Volatility factor, as defined in the Barra Global Equity Model 2 ([GEM2](#))<sup>1</sup>, can be used to understand how a portfolio is positioned for changes in risk aversion. In a previous note, "The Volatility Factor and Risk Aversion," presented in the [Q1 2012 newsletter](#), we explained how returns to the Volatility factor can provide a measure of investors' risk appetite. Now we extend this analysis and show how specific groups of stocks, like those exposed to a certain country or industry, are also exposed to the Barra Volatility factor. This exercise identifies the stocks more likely to be impacted by a shift in risk aversion. For this analysis we group stocks in the MSCI ACWI IMI index by country and sector. Through a heat-map analysis, we show how exposures to the Volatility factor can differ significantly across countries, regions and sectors, offering valuable insight into the perceived riskiness of some countries and sectors versus others.

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<sup>1</sup> The Barra Global Equity Model 2 is a global multi-factor risk model used by fund managers to help construct and manage global equity portfolios.

## Market Review

A positive sentiment dominated the markets from December 2011 through February 2012. High levels of volatility observed during the summer of 2011 started subsiding in December of that year, and returns on equity indices also showed a marked recovery.

Chart 1 shows the daily returns and 20-day daily realized volatility (standard deviation of daily returns) of the MSCI ACWI IMI index, which includes global large-, mid- and small-cap stocks. It shows how the sharp increase in volatility that started in August of 2011 was followed by a sustained decline. By February of 2012, realized volatility had returned to levels observed in the first half of 2011.

Chart 1: MSCI ACWI IMI Index: Daily returns and 20-day daily volatility

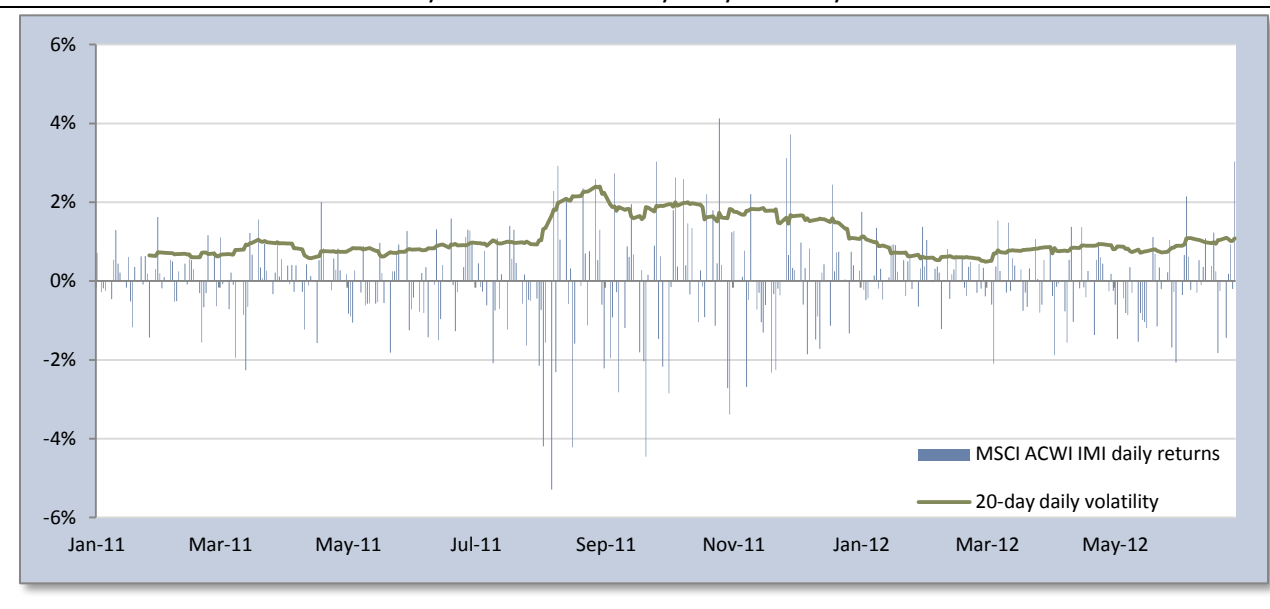
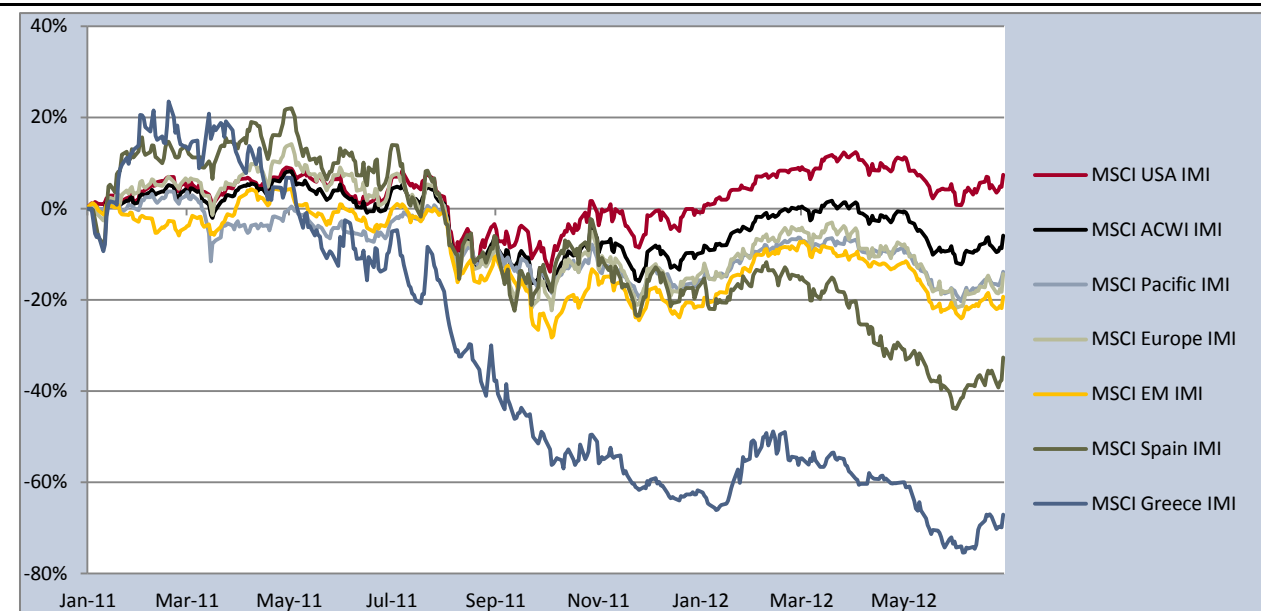


Chart 2 shows the cumulative returns of some MSCI indices. The MSCI ACWI IMI index posted a cumulative return of more than 15 percent between December 2011 and February 2012. The MSCI USA IMI rallied by more than 20 percent in the same period. The positive performance of the markets during this period can be attributed to general optimism about the world economy, including a healthier labor market in the United States and reduced concerns about the ability of certain European states to remain in the Eurozone.

However, the sentiment toward equities (and the generalized optimism observed in the first months of the year) took a turn by the end of the first quarter. Concerns about a hard landing in China and lower than expected job creation in the United States, combined with renewed concerns about the ability of countries in the Eurozone to execute austerity measures, reignited fears that led to a generalized correction in the markets.

Chart 2: MSCI IMI Indices: Total return in USD



## Interpreting Volatility Factor Returns . . .

In a [previous note](#) we explained how returns to the Volatility factor could be used as a proxy for investors' risk appetite. The logic is as follows: the performance of the Volatility factor mirrors that of a long/short portfolio that holds high-volatility stocks long and low-volatility stocks short. By definition, an increase in risk aversion reduces the appetite for risky stocks. This could prompt investors to rebalance their portfolio, reducing their holdings of risky (or more volatile) stocks. These relatively risky stocks could underperform other less risky stocks, resulting in a negative return to the Volatility factor. The opposite could also be true: a decrease in risk aversion could increase demand for riskier stocks (relative to less risky ones), resulting in a positive return to the Volatility factor. Thus, one could potentially interpret the performance of the Volatility factor as an indicator of risk aversion.

Chart 3 illustrates how Volatility factor returns mirrored the perceived *risk on/risk off* shift that occurred between late 2011 and mid-2012. A *risk on* period of increased risk appetite during late 2011 and early 2012 pushed returns to the Volatility factor five percent higher. However, risky stocks started losing traction in mid-March 2012 and a *risk off* market environment took over again, resulting in a seven percent drop in the Volatility factor.

Chart 3: GEM2 Volatility factor returns



Returns to the GEM2 Volatility factor can be very useful in understanding general market behavior and trends in risk aversion from a global perspective. The returns to this factor are calculated from a large, global pool of stocks, so they reflect global trends in the behavior of high- and low-volatility stocks (net of other factors). However, **the global nature of the Volatility factor returns means that these returns are not useful to understand how changes in risk aversion will affect specific stocks, like those exposed to a specific country or sector.** For information specific to a region or sector we use the exposures to the Volatility factor instead. For example, knowing that the first half of 2012 presented a *risk on* followed by a *risk off* period does not tell you anything about the impact that these shifts in risk aversion will have on a specific stock or a group of stocks. To do that, you need to look at the Volatility *exposure* that the stocks have.

### ... And Volatility Factor Exposures

To calculate exposures to the Volatility factor, the Barra GEM2 classifies stocks as high- and low-volatility based on three observed measures of volatility: historical beta, range and daily standard deviation. These three indicators are combined and standardized. The resulting numeric representation of the relative volatility of a stock is called the *exposure* of a stock to the Volatility factor.

This number helps equity portfolio managers understand which stocks (or groups of stocks, like countries or sectors) are perceived to be more (or less) exposed to changes in risk aversion based on the data analyzed by the model. Furthermore, this information can be used to understand how your portfolio is positioned for changes in risk aversion through the portfolio's exposure to the Volatility factor. **Most importantly, Barra risk models help you understand which stocks (or groups of stocks, like regions or sectors) contribute the most to the risk aversion positioning of a portfolio.** This helps you build portfolios that more accurately reflect your views and expectations.

Chart 4 is a heat map that illustrates differences in exposures to the GEM2 Volatility factor across countries and sectors represented in the MSCI ACWI IMI index as of June 30, 2012. Each cell in the heat map shows the rebased weighted average exposure of the stocks in the overlap of the sector (x-axis) and country (y-axis, grouped by region) would have to the Volatility factor. For example, the table indicates that the intersection of USA and Utilities has an exposure of -1.08. This means that screening the MSCI ACWI IMI for stocks that are both American and Utilities, produces a USA Utilities portfolio that would have an exposure to the GEM2 Volatility factor of -1.08. The negative exposure supports the notion that Utilities are on average defensive bets that perform better than other equity sectors when risk aversion increases.

Chart 4: Volatility factor exposures by region/country and sector as of June 30, 2012

|                | Consumer Discretionary | Consumer Staples | Energy | Financials | Health Care | Industrials | IT    | Materials | Telecoms | Utilities | Total |
|----------------|------------------------|------------------|--------|------------|-------------|-------------|-------|-----------|----------|-----------|-------|
| Canada         | -0.73                  | -1.00            | 0.22   | -0.77      | 0.12        | -0.35       | 0.27  | 0.42      | -1.39    | -1.02     | -0.27 |
| USA            | 0.29                   | -0.86            | 0.35   | 0.36       | -0.36       | 0.34        | 0.35  | 0.69      | -0.73    | -1.08     | 0.08  |
| Austria        |                        |                  | 0.28   | 1.22       | 1.03        | 0.11        | 0.27  | 0.88      | -0.69    | -0.38     | 0.53  |
| Belgium        | 0.43                   | -0.41            | 1.02   | 0.81       | -0.30       | 1.18        | 0.29  | 1.01      | -0.62    | -1.30     | -0.04 |
| Finland        | 1.20                   | 0.47             | 1.54   | 0.24       | -0.34       | 1.26        | 1.68  | 1.37      | -0.66    | -0.40     | 0.88  |
| France         | 0.50                   | -0.38            | 0.11   | 1.65       | -0.59       | 0.70        | 0.76  | 0.59      | -0.11    | 0.40      | 0.38  |
| Germany        | 0.87                   | -0.40            | 0.21   | 0.84       | -0.06       | 0.35        | 0.08  | 0.59      | -0.61    | 0.33      | 0.41  |
| Greece         | 1.69                   | 0.72             | 0.48   | 2.23       |             | 1.28        |       | 1.30      | 2.67     | 2.25      | 1.53  |
| Ireland        | -0.62                  | -0.54            |        | 2.14       | 0.00        | -0.37       |       | 1.06      |          |           | 0.32  |
| Italy          | 1.13                   | -0.67            | 0.51   | 1.89       | 0.00        | 1.19        | 0.67  | 1.11      | 0.20     | 0.22      | 0.94  |
| Netherlands    | -0.28                  | -0.96            | 1.32   | 1.97       | -0.43       | 0.52        | 0.46  | 0.23      | -0.21    |           | 0.15  |
| Portugal       | 0.10                   | -0.52            | 0.65   | 1.81       |             | 0.01        |       | -0.38     | -0.21    | -0.22     | 0.09  |
| Spain          | 0.17                   | -0.26            | 1.31   | 1.14       | 0.36        | 0.56        | 0.17  | 0.60      | 0.40     | 0.64      | 0.74  |
| Denmark        | 0.61                   | 0.07             |        | 0.03       | -0.45       | 0.61        | -0.36 | -0.71     | -1.05    | 0.18      | -0.20 |
| Norway         | 0.78                   | 0.91             | 0.27   | 0.78       | 0.85        | -0.08       | 0.78  | 0.71      | -0.44    |           | 0.33  |
| Sweden         | 0.10                   | -0.93            | 1.18   | 0.43       | -0.03       | 0.90        | 0.11  | 0.58      | -0.56    |           | 0.37  |
| Switzerland    | 0.78                   | -1.35            | 0.48   | 0.29       | -0.98       | 0.12        | 0.96  | -0.08     | -1.20    | -0.49     | -0.52 |
| United Kingdom | -0.05                  | -0.91            | -0.02  | 0.43       | -1.04       | 0.09        | 0.47  | 1.12      | -0.85    | -1.29     | -0.14 |
| Australia      | -0.48                  | -1.23            | 0.00   | -0.58      | -0.75       | -0.43       | -0.50 | 0.15      | -1.16    | -0.91     | -0.43 |
| Hong Kong      | 0.64                   | -0.50            | 0.90   | -0.16      | 0.66        | -0.05       | 0.35  | 0.83      | -0.53    | -1.47     | -0.16 |
| Japan          | -0.17                  | -1.04            | 0.11   | -0.17      | -0.95       | -0.16       | -0.03 | 0.04      | -0.80    | -1.04     | -0.30 |
| New Zealand    | -1.13                  | 0.15             | -0.52  | -1.71      | -1.25       | -1.34       |       | -0.76     | -1.05    | -1.37     | -1.16 |
| Singapore      | -0.62                  | 0.15             | 0.82   | -0.64      | -0.19       | -0.25       | -0.62 | 1.07      | -1.31    | -0.01     | -0.55 |
| China          | 0.66                   | -0.14            | 0.41   | 0.55       | 0.35        | 0.78        | 0.63  | 1.09      | -0.86    | -0.34     | 0.36  |
| India          | 0.24                   | -0.54            | -0.44  | -0.02      | -0.74       | 0.33        | -0.13 | 0.24      | -0.09    | -0.17     | -0.10 |
| Indonesia      | -0.27                  | -0.11            | 0.80   | -0.14      | -0.16       | 0.13        | 0.90  | 0.11      | -0.69    | 0.24      | -0.08 |
| Korea          | 0.15                   | -0.68            | 0.97   | 0.11       | 0.36        | 0.70        | 0.33  | 0.46      | -0.80    | -0.78     | 0.27  |
| Malaysia       | -0.74                  | -1.11            | -0.81  | -1.29      | -0.81       | -0.96       | -0.23 | -0.93     | -1.37    | -0.89     | -1.08 |
| Philippines    | -0.24                  | -0.27            | 0.32   | -0.07      |             | -0.32       |       | -0.08     | -0.70    | -0.63     | -0.29 |
| Taiwan         | -0.07                  | -0.48            | -0.10  | 0.02       | 0.02        | 0.01        | 0.24  | -0.28     | -1.43    | -1.20     | 0.01  |
| Thailand       | 0.07                   | -0.60            | -0.08  | 0.11       | -0.35       | -0.36       | -0.60 | 0.24      | -0.68    | -0.72     | -0.09 |
| Brazil         | 0.59                   | -0.48            | 0.50   | 0.21       | -0.35       | -0.18       | -0.57 | 0.28      | -0.35    | -0.59     | 0.06  |
| Chile          | -0.32                  | -0.51            |        | -0.62      | -0.92       | -0.17       | -0.47 | -0.31     | -1.17    | -0.92     | -0.53 |
| Colombia       | -1.60                  | -1.04            | -0.25  | -0.96      |             |             |       | -0.61     |          | -0.70     | -0.68 |
| Mexico         | -0.39                  | -0.52            |        | 0.49       | -0.13       | 0.01        |       | 0.62      | -0.38    |           | -0.14 |
| Peru           |                        | 0.28             | 0.17   | -0.20      |             | 0.18        |       | 0.02      |          |           | -0.05 |
| Egypt          | -0.10                  | -0.43            | 0.35   | -0.02      |             | -0.59       |       | 0.35      | 0.05     |           | -0.18 |
| Israel         | 0.05                   | -0.79            | -0.67  | -0.10      | -0.55       | -0.29       |       | -0.11     | 0.21     |           | -0.34 |
| Morocco        |                        |                  |        | -0.79      |             |             |       | -0.95     | -1.32    |           | -0.97 |
| South Africa   | -0.43                  | -0.80            | -0.55  | -0.87      | -0.89       | -0.63       | -0.87 | -0.50     | -0.77    |           | -0.67 |
| Turkey         | 0.03                   | -0.30            | -0.04  | -0.03      | -0.12       | -0.08       | 0.81  | 0.00      | -0.77    | 0.69      | -0.12 |
| Czech Republic | -0.04                  | -1.36            |        | -0.29      |             |             |       | -1.61     | -1.70    | -0.90     | -0.92 |
| Hungary        |                        |                  | -0.04  | 1.52       | -0.69       |             |       |           | -0.56    |           | 0.30  |
| Poland         | -0.12                  | 0.29             | -0.10  | -0.08      | 1.60        | 0.68        | -0.20 | 0.87      | -0.98    | -0.50     | -0.01 |
| Russia         | 0.18                   | -0.31            | 0.00   | 0.71       | 0.45        | 0.46        |       | 0.01      | -0.08    | 0.75      | 0.12  |
| Total          | 0.19                   | -0.85            | 0.26   | 0.17       | -0.50       | 0.23        | 0.31  | 0.47      | -0.69    | -0.81     | 0.00  |

Additionally, total figures for countries and sectors can be found at the right and bottom margins of the table. For example, the total exposure for Eurozone countries ranges from -0.04 (Belgium) to 1.53 (Greece). These exposures, the highest for any region, suggest that (not surprisingly) Eurozone stocks are currently the most affected by shifts in risk aversion as reflected by the returns to the Volatility factor. Empty cells in the heat map represent intersections that yield an empty portfolio (e.g. IT companies in Mexico).

To make the table easy to read, we added a color code. Low exposures to the Volatility factor (i.e. low-volatility portfolios) are shaded blue. High exposures to the Volatility factor (i.e. high-volatility portfolios) are shaded red. The intensity of the shade corresponds to how positive (or negative) the exposure of a portfolio is.

This heat map allows us to identify several interesting patterns, which illustrate how much a certain country or sector is affected by changes in global risk aversion. For example:

- As might be expected given current events, Greece is the country with the largest exposure to the Volatility factor. In fact, every sector in Greece is positively exposed to the Volatility factor. More generally, the Eurozone is the region most exposed to the Volatility factor.
- Three sectors have consistently low exposures to the Volatility factor across several regions and countries: Consumer Staples, Utilities and Telecoms. In fact, the latter is negatively exposed to the Volatility factor across almost all countries, except for Greece, Italy Spain, Egypt and Israel.
- Even though Materials is the sector most exposed to the Volatility factor globally, there is—unsurprisingly—a cluster of companies in the Financial sector in the Eurozone that shows very high exposures to the Volatility factor.

## Conclusion

This analysis shows how Barra factors—in particular, the Volatility factor in Barra Global Equity Model 2—can be used to understand how a portfolio expresses a view on risk aversion. Furthermore, the heat map analysis of the Volatility exposures of country/sector intersections in the MSCI ACWI IMI index showed that the range of exposures across regions and industries can be large. This illustrates how you can use Barra models to measure and quantify the impact of shifts in risk appetite on your portfolios, making sure that they accurately reflect your views on risk aversion.

Note that this analysis is only a snapshot of the Volatility factor exposures across sectors, countries and regions. Two things need to be kept in mind:

- The exposure to a single factor (in this case GEM2's Volatility factor) is only a partial view of the risk profile of a portfolio. For an accurate representation of the risk profile of a portfolio, other factors must be taken into account.
- Exposures change significantly over time, reflecting the underlying market environment. In future notes, we will analyze the historical behavior of the heat map presented above, showing how economic, political and natural events are reflected in Barra models.

Additionally, future notes will replicate this analysis with our new-generation Global Equity Model 3 ([GEM3](#)). This new model breaks down the Volatility factor into two components, Beta and Residual Volatility, adding more transparency to the drivers of change in market sentiment.

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<sup>1</sup>As of June 30, 2011, based on eVestment, Lipper and Bloomberg data.