## Introduction

Globalization has led to the growing influence of global factors in the behavior of stock prices. Most studies on the unequal impact of globalization focus on differences across countries or geographical regions. Certain individual industries however, are more sensitive to global factors than others; for example the airline industry is widely considered to be significantly more globally oriented than commercial services. This research bulletin uses the new and enhanced Barra Global Equity Model (GEM2) to measure global exposure and investigate the variation in global exposure across industries. Determining whether an industry is global in nature or local-based may have important implications for sector diversification in portfolio implementation. Besides, the analysis of differences between industries with varying degrees of global exposure will be extended to study its association with style characteristics, as well as returns and risk.

Variation in Global Exposure Across Industries

Different industries have different exposures to the global environment. Global sectors with higher exposure are more influenced by global factors; local sectors are more insulated from these factors. The new and enhanced Barra GEM2 model provides a proxy measure of this global exposure. Since all factors in the model are global in nature, the part of stock returns not captured by the factors – the residual – measures how insulated a firm is from the global environment. This residual corresponds to specific risk or asset selection risk, and while this risk may be structurally high or low for individual sectors, it is a reasonable estimate of the purely local part of a stock's total risk. To ensure that this measure is independent of the total risk of a security, the ratio of specific to total risk is calculated. Furthermore, as a measure of global exposure the reciprocal is used:

$$Global\ Exposure\ = \frac{1}{Specific\ Risk/Total\ Risk}$$

**Figure 1: Global Exposure of Various Industries (Monthly Averages, 1998-2008)**
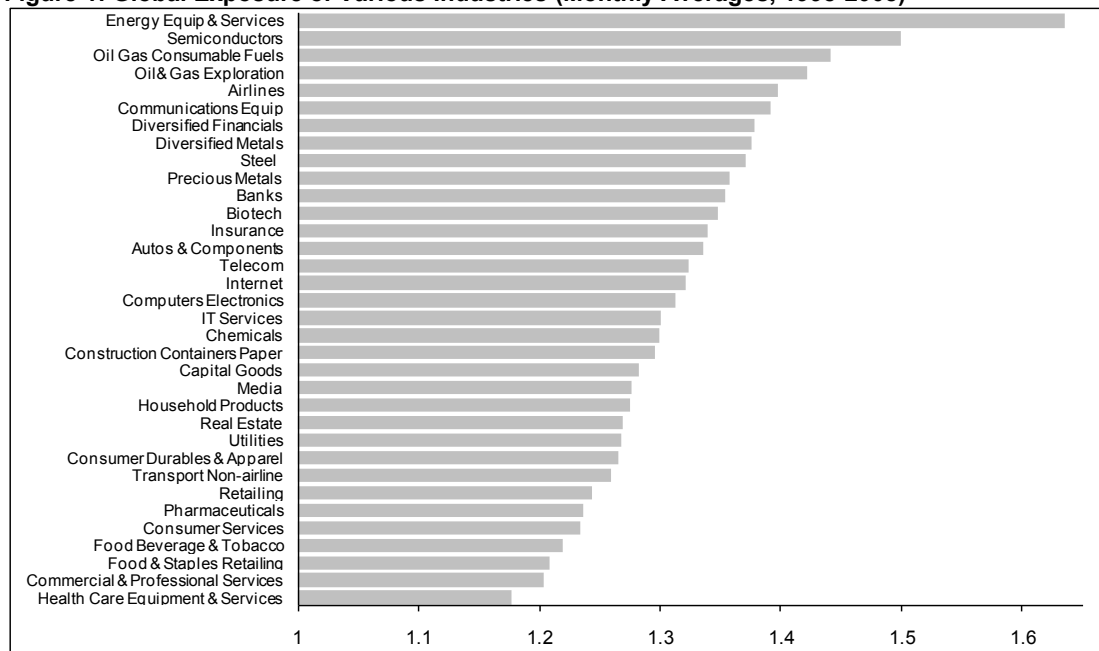
In the Barra GEM2 model, there are 34 industry factors that cover all 24 Global Industry Classification Standard (GICS®) industry groups, as well as selected GICS® industries and sub-industries.[1] The average global exposure scores for these industries over the last 10 years are displayed in Figure 1. Several sectors stand out as having high global exposure. The most obvious are the energy-related industries, taking three of the five top spots. These energy-related industries are driven to a large extent by the price of energy, which is a globally traded commodity and therefore less likely to be local in nature. Other commodity-based industries also rank highly, such as diversified metals, steel, and precious metals. Like energy, these are also driven by commodity market trends and tend to be more globally oriented. The IT sector is also one of the more global sectors, with semiconductors and communications equipment near the top of the list. Lastly, the financials are also relatively global, with diversified financials, banks, and insurance in the top half of the group.

At the lower end of the list, services tend to predominate, which is expected because services are generally less traded on a global scale. The bottom five industries on the list are services that cover consumer and commercial areas and also include food and healthcare. Non-airline transport stands in contrast to airlines, since non-airline transport is generally more local and their services are generally more geographically confined. Other more local industries include retail, consumer durables, and household products.

Style Characteristics of Industries with Varying Global Exposures

To determine if the more global industries exhibit any clear style characteristics, we take the average style exposures of the 34 GEM2 industries according to the eight style factors in GEM2: Size, Size Nonlinearity, Value, Growth, Leverage, Liquidity, Volatility, and Momentum. The correlation of these style exposures with the global exposures previously computed are shown in Figure 2. Positive correlations indicate that more global industries tend to also have high exposures in a given style. The reverse is true for negative correlation values. The two styles that stand out in terms of absolute magnitude are volatility and liquidity. Both are positive, implying that the more volatile and actively traded stocks over the last 10 years are those coming from the global industries.[2]

Figure 2: Correlation of Global Exposures with GEM2 Style Factor Exposures (1998-2008)
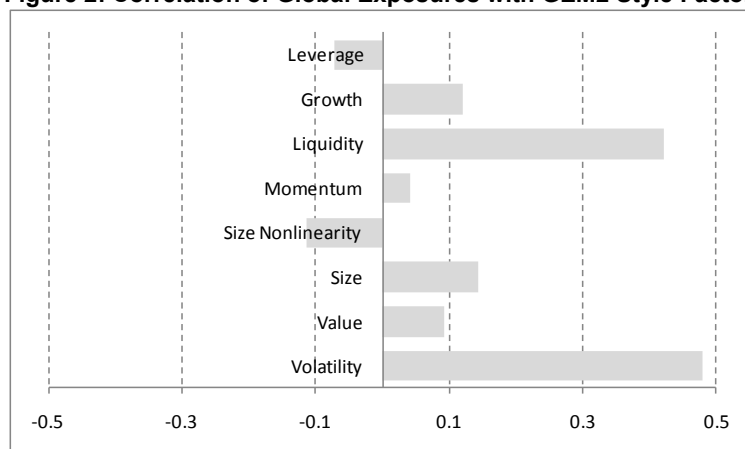
Note: The style factor exposures for the 34 industries are obtained for each month of the ten-year period, and then their correlation with the global exposures on the corresponding month are computed. These correlations are then averaged over the ten-year period for each style factor to get the final correlation.

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[1] For details on the selection criteria for these industry factors, see pp. 11-12 in Menchero, Jose, Andrei Morozov and Peter Shepard (2008), *The Barra Global Equity Model (GEM2)*, MSCI Barra Model Insights (September).
[2] Liquidity is a local-relative factor in GEM2 and so liquid stocks here refer to those that are most liquid in their respective markets.

Comparing Returns of Industries with Different Global Exposures

Next, we examine the return characteristics of industries with different global exposures. First, we compare the industry factor returns for the 34 GEM2 industries with their global exposure scores, as displayed in Figure 3. The advantage of using GEM2 industry factor returns here is apparent; industries differ according to firm size, degree of financial leverage, or whether they are value or growth oriented, and the effect of these influences should be removed to ensure a fair comparison across industries.[3]

Figure 3: Industry Factor Returns versus Global Exposure (1998-2008)
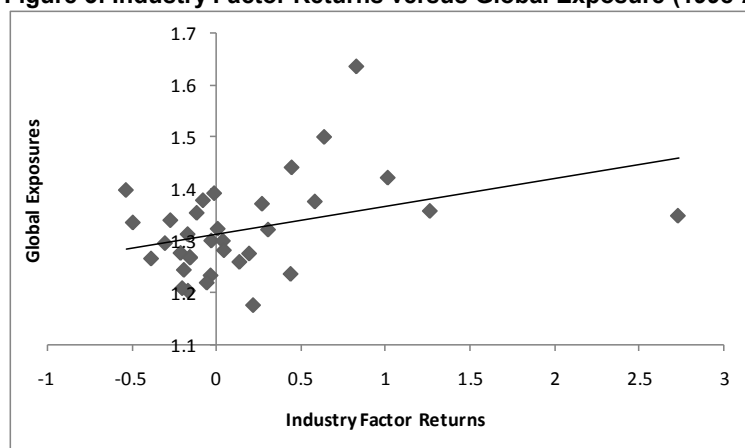
The best-fit linear line in Figure 3 suggests a positive relationship between an industry's stock return and its global exposure, with a correlation coefficient of 0.36. This relationship is also found to be statistically significant at the 95% confidence level.[4] This suggests that within this sample period, the more globalized sectors seemed to perform better than their local counterparts. For industries on a global basis, global shocks tend to dominate local ones in scale. While clearly important at the local level, local factors tend to cancel out when aggregated across countries at the global level because they are independent across geographical areas. If global shocks are generally positive, industries with higher global exposure tend to perform better. The relationship between returns and degree of global exposure requires further analysis however, since it may differ at different stages of the stock market cycle. For this reason, the correlation coefficients are computed separately for the four sub-periods corresponding to bull and bear markets in the last ten years (Figure 4).

Figure 4: Correlation between GEM2 Industry Factor Returns and Global Exposure

	Bull Market	Bear Market	Bull Market	Bear Market	Whole Period
	Dec 1998 to Mar 2000	Apr 2000 to Mar 2003	Apr 2003 to Oct 2007	Nov 2007 to Dec 2008	Dec 1998 to Dec 2008
Correlation Coefficient	0.52***	-0.20	0.36**	-0.33*	0.36**

*Note: Bull and bear market periods are determined by the peaks and troughs of the MSCI All Country World Index, while *, **, and *** indicate statistical significance at the 90%, 95% and 99% confidence levels respectively.*

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[3] Evidence of differences in financial leverage across industries, for instance, was presented in *Financial Leverage*, MSCI Barra Research Bulletin, October 2008.
[4] This is based on a two-tailed hypothesis test, with an associated p-value of 0.036.

The results suggest that there are significant differences across bull and bear markets. In bull markets, more global sectors tend to outperform, but the reverse is true under bear market conditions. Additionally, the link between industry returns and global exposure is stronger in bull market periods, as reflected by the higher degree of statistical significance.

When the global stock market is bullish, global market drivers are positive, and the more globalized industries benefit from having greater sensitivity to these factors. Conversely, when these global factors become negative during bear market conditions, the globalized industries generally suffer. The weaker relationship during bear markets may be due to the heightened correlation between all stocks during these times, regardless of their degree of global exposure.

Next, Figure 5 plots the volatility of the various industries against their global exposures, showing a strong positive relationship consistent with the usual tradeoff between risk and returns. This is also consistent with the earlier finding that the more global sectors have higher exposures to the volatility factor in the Barra GEM2 model. Therefore, while industries with higher global exposures have performed well in the past, they have also been more volatile due to their greater sensitivity to global shocks.

Figure 5: Comparing Volatility and Global Exposure for Various Industries (Annualized figures, Dec 1998 – Dec 2008)
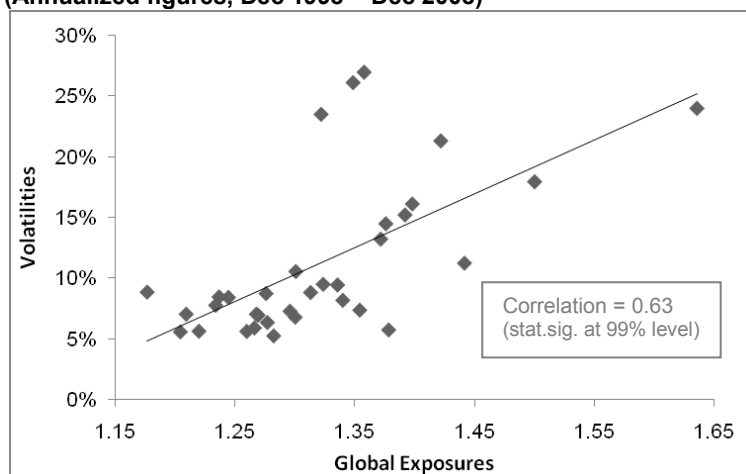
Conclusion

While globalization has caused stock returns to become more correlated, its impact on different industries may differ. Understanding the degree of global exposure has important investment implications, especially for portfolio diversification. This research bulletin introduces the reciprocal of the specific to total risk ratio as a proxy measure of global exposure. It found that over the last 10 years, industries related to energy and other commodities had high global exposure, as well as those in IT and finance. On the other hand, services generally rank low in terms of their sensitivity to global forces, probably due to the limited geographic reach of their markets. Examining the style characteristics of the stocks in the global industries reveals that they tend to be high in volatility and liquidity. Interestingly, there also seems to be a generally positive relationship between global exposure and industry returns for these industries. This relationship however varies over the global stock market cycle, with firms with higher global exposure having the tendency to outperform in bull markets and underperform during bear market periods. In addition, the higher returns of the more globalized industries are subject to the usual risk-return tradeoff because they are also more volatile.

Earlier Research Bulletins in GEM2 Series:

Country and Industry Effects in Global Equities (Oct 2008)
Financial Leverage (Oct 2008)
A Look at the Liquidity Factor in GEM2 (Dec 2008)
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