This is the fourth in a series of research bulletins marking the launch of the new and enhanced Barra Global Equity Model (GEM2). In this piece, we focus on characteristics of the global momentum factor. Under varying market conditions, the performance of the momentum factor will be examined, especially in bull versus bear markets. In addition, the global diversification benefits for this strategy will be analyzed. We also consider the implied country and sector tilts in a momentum strategy, as well as the interaction between momentum and other style factors, such as value and growth.

Introduction

The momentum investment strategy is based on purchasing equities that have recently outperformed the market while selling stocks that have underperformed, with the expectation that this current momentum will continue. This research bulletin considers some of the characteristics of momentum stocks in the context of the GEM2 model, which will enable us to gain a better understanding of how momentum behaves as a risk factor. Based on the extensive global equity universe covered by the model, we shall examine the various characteristics of momentum, including diversification benefits that arise from extending coverage from individual markets to the global universe. The implicit geographical and industry tilts of the momentum strategy will also be analyzed, as will the relationship with other style factors, such as value and growth.
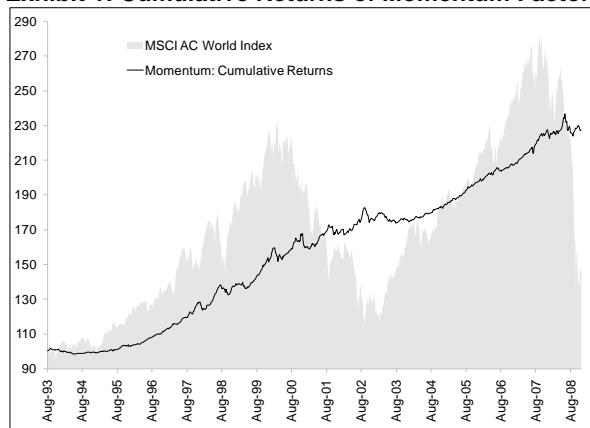
The Momentum Factor in GEM2

The momentum factor ranks among the most important style factors in the new and enhanced Barra Global Equity Model (GEM2).[1] Simply defined, momentum is a measure of the success of each stock, based on recent price performance.

There are two descriptors associated with this factor: relative strength and historical alpha. The relative strength index is the cumulative log return of the price of the stock over the preceding six- and twelve-month periods, minus the corresponding return of the risk-free rate. Historical alpha is computed with the usual regression, using weekly observations from the preceding 104 weeks.

Exhibit 1 shows cumulative returns of the momentum factor compared with the MSCI All Country World Index (MSCI ACWI). Based on this chart, we can observe that the momentum factor is considerably less volatile than the market index. Since the estimation universe is largely consistent with the MSCI ACWI, the momentum captured by this factor is a global phenomenon not specific to one country or region.

Exhibit 1: Cumulative Returns of Momentum Factor in GEM2

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[1] See pp. 13-14 in Menchero, Jose, Andrei Morozov and Peter Shepard (2008), "The Barra Global Equity Model (GEM2)", *MSCI Barra Model Insights* (September).

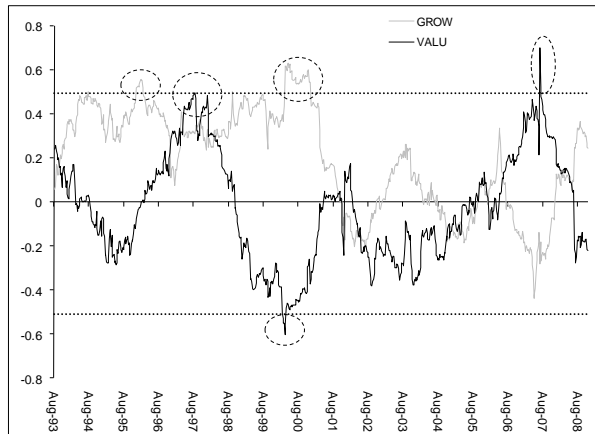**Exhibit 2: Comparing Momentum Returns for Various Markets (Aug 92 to Dec 08)**

	Global	USA	Europe	Japan
Annualized Return	4.02%	-0.56%	2.48%	-3.76%
Volatility (annualized)	4.15%	5.75%	4.02%	4.90%
Return/Volatility	0.97	-0.10	0.62	-0.77

Note: The momentum returns are based on the corresponding momentum factors from the GEM2, USE3, EUE2 and JPE3, respectively.

In fact, the effect of a worldwide universe is evident in Exhibit 2, which compares the momentum factor returns in GEM2 with the corresponding returns from the single-market models for the US, Europe and Japan. The momentum factor worked significantly better on a global basis than individually in each of these three markets, which in terms of market capitalization constitute the bulk of the global universe.
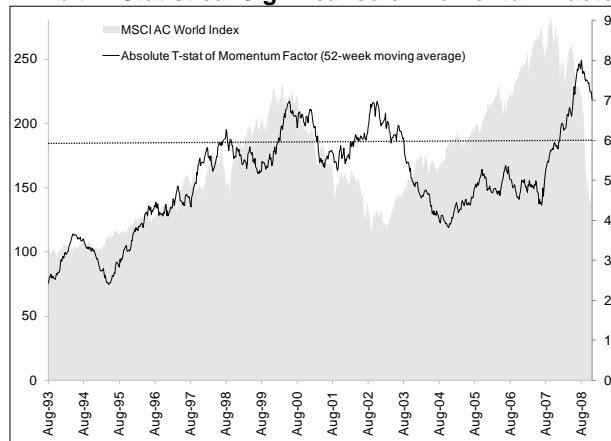
Among equity style factors, momentum often features prominently with growth and value. It is worth examining how these risk factors are related to one another. Exhibit 3 shows momentum's correlation with the growth and value factors in GEM2. Generally, the correlations tend to move in opposite directions; as correlation with growth rises, value tends to fall. Generally, the correlations are confined to the -0.5 to +0.5 range, whether for growth or value, with sharp retracements following periods when the range was surpassed. This holds true at the end of the bull run for growth stocks in 2000, as well as for value stocks in 2007. The sharp rise in momentum's correlation with value in the latter episode was particularly striking (see rightmost circled part in Exhibit 3), and ultimately resulted in the Quant Meltdown at that time. Many quantitative managers emphasize momentum and value in their investment framework, and when both factors are moving strongly in the same direction, the likelihood of concentrated bets is very high. A risk manager could therefore use the correlations as indicative signals to provide an early warning that a strategy may have become overstretched because of excessive bets in the market.

Exhibit 3: Momentum's Correlation with Growth and Value

It is also worth investigating the variation in the explanatory power of the momentum factor over time. For this purpose, consider the absolute value of the t-statistic for the momentum factor in the GEM2 model. This measure is shown in Exhibit 4, smoothed by using a 52-week moving average. The shaded series in the background is the cumulative MSCI ACWI performance. When the absolute t-statistic becomes high, it implies that momentum is very significant statistically, whether the market is in a bear or bull market situation. It may be observed that the explanatory power of the momentum factor tends to be strongest near the turning points in the stock market. In particular, this characteristic marks the end of the bull markets in 2000 and 2008 and the bear market in 2003.

Exhibit 4: Statistical Significance of Momentum Factor in GEM2

Implicit Country and Industry Tilts in Employing a Momentum Strategy

Due to variation in price performance across markets and across sectors, the use of a momentum strategy may often involve hidden tilts. Exhibit 5 shows various regional markets with their momentum exposure and ranking over the last ten years. A quick glance at the average for the whole period between 1998 and 2008 (final column) indicates that a global momentum strategy involves an obvious bias towards emerging market countries. Therefore, a global momentum strategy would necessarily involve geographical tilts. Understanding the regional or country biases are important particularly from a risk management perspective, as well as for adhering to required geographical limits.

Exhibit 5: Momentum Exposure Rank for Various Regional Markets (Dec 1998 – Dec 2008)
(Rank = 1 to 7, 1 = region with highest momentum, 7 = region with lowest momentum)

	Bull Market Dec 1998 to Mar 2000		Bear Market Apr 2000 to Mar 2003		Bull Market Mar 2003 to Oct 2007		Bear Market Nov 2007 to Dec 2008		Bull Market Average		Bear Market Average		Whole Period Average	
	Exposure	Rank	Exposure	Rank	Exposure	Rank	Exposure	Rank	Exposure	Rank	Exposure	Rank	Exposure	Rank
Developed Markets														
North America	0.03	2	0.07	2	-0.09	7	0.03	4	-0.06	7	0.06	3	-0.01	5
Europe	-0.08	3	-0.10	6	-0.03	6	-0.15	6	-0.04	6	-0.12	6	-0.07	7
Japan	0.07	1	-0.13	7	0.06	5	-0.34	7	0.07	5	-0.19	7	-0.04	6
Pacific ex Japan	-0.11	5	0.01	3	0.14	4	0.14	3	0.09	3	0.05	5	0.07	4
Emerging Markets														
EM Asia	-0.09	4	-0.09	5	0.28	2	0.41	1	0.20	1	0.05	4	0.14	1
EM EMEA	-0.48	6	0.25	1	0.24	3	0.03	5	0.09	4	0.19	1	0.13	2
EM LATAM	-0.48	7	0.01	4	0.30	1	0.39	2	0.13	2	0.11	2	0.12	3

Note: Bull and bear market periods are determined by the peak and trough values of the MSCI ACWI. The momentum exposure for a given region at a point in time is a cap-weighted average of stocks' weekly exposures within that region, while a region's exposure in a given time period is a simple average of the weekly regional exposures within that period.

Exhibit 5 also shows how momentum involves regional tilts that change over time. In the first bull market from 1998 to 2000, there was a tilt towards North America and Japan, while tilting away from emerging markets. In the next bull market from 2003 to 2007, it was almost the exact opposite, with emerging markets enjoying high momentum, while North America performed relatively poorly. Over the entire 10-year period, the final column indicates that emerging market stocks generally displayed higher momentum, while their developed markets counterparts had below-average momentum.

Comparing momentum in bull and bear markets is also of interest; therefore, corresponding momentum ranks are presented separately in Exhibit 5 l. Note that equities with the highest momentum rank in a bear market are those that fell the least. The measure of momentum in

GEM2 is upside momentum, and those stocks that decline most drastically in bear market are hence assigned the lowest momentum exposures. The correlation between the average momentum exposures in bull and bear markets for individual countries is merely 0.08, indicating that high momentum in bull markets does not imply either high or low momentum in bear markets. This also implies that countries with higher momentum on the upside do not necessarily display higher downside momentum in a bear market correction.

Likewise, we can analyze industry tilts for the momentum factor. The corresponding momentum ranks for the ten GICS® sectors are given in Exhibit 6. The Materials sector, which covers precious and diversified metals, steel, forest products and other commodity-related industries, was the highest ranked sector for the entire ten-year period, while Energy was second. This was largely a result of the commodities boom over this period. Consumer Staples and Telecoms, which are traditionally defensive sectors, were at the other extreme with the lowest momentum exposures for the last ten years.

Exhibit 6: Momentum Exposures for Various GICS® Sectors (Dec 1998 – Dec 2008)
(Rank = 1 to 10, 1=highest momentum, 10=lowest momentum)

	Bull Market Dec 1998 to Mar 2000		Bear Market Apr 2000 to Mar 2003		Bull Market Mar 2003 to Oct 2007		Bear Market Nov 2007 to Dec 2008		Bull Market Average		Bear Market Average		Whole Period Average	
	Exposure	Rank	Exposure	Rank	Exposure	Rank	Exposure	Rank	Exposure	Rank	Exposure	Rank	Exposure	Rank
Consumer Disc	0.02	3	0.02	6	-0.03	6	-0.24	9	-0.02	7	-0.06	7	-0.04	6
Consumer Stpl	-0.35	8	-0.01	7	-0.13	9	0.14	4	-0.17	10	0.03	4	-0.09	9
Energy	-0.39	9	0.05	2	0.15	3	0.11	5	0.04	6	0.07	2	0.05	2
Financials	-0.32	6	0.02	4	0.03	5	-0.28	10	-0.05	8	-0.06	8	-0.05	7
Health Care	-0.15	4	0.05	3	-0.16	10	-0.08	8	-0.16	9	0.01	6	-0.09	8
IT	0.68	1	-0.10	9	-0.12	8	-0.02	7	0.05	3	-0.08	9	0.00	5
Industrials	-0.25	5	0.02	5	0.12	4	0.04	6	0.04	5	0.02	5	0.03	4
Materials	-0.42	10	0.06	1	0.24	1	0.42	1	0.10	1	0.16	1	0.13	1
Telecom	0.49	2	-0.49	10	-0.07	7	0.22	2	0.05	4	-0.29	10	-0.09	10
Utilities	-0.34	7	-0.02	8	0.16	2	0.19	3	0.06	2	0.04	3	0.05	3

Note: Bull and bear market periods are determined by the peak and trough values of the MSCI ACWI. The momentum exposure for a given sector at a point in time is a cap-weighted average of stocks' weekly exposures within that sector, while a sector's exposure in a given time period is a simple average of the weekly sectoral exposures within that period.

Conclusion

The momentum factor, which measures relative performance of high-momentum stocks, plays an important role in the new and enhanced Barra Global Equity Model (GEM2). This Research Bulletin found that the momentum factor is stronger on a global basis than in individual markets, which points to the diversification and other benefits of a wider universe. Furthermore, the correlation of momentum with other style factors in the model, such as value and growth, was found to peak at turning points in the value-growth cycle. The momentum factor was also found to have significant country and industry tilts that are important from a risk management perspective.

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