How to Assess Real Exchange Rate Overvaluation

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In several recent client meetings, we were asked "Why do you measure real exchange rate overvaluation as the percentage difference between the current level of the real exchange rate and its 6-year moving average? Why not compare the current level to a shorter or longer moving average?" All we could really say at the meetings was that we have been calculating real FX overvaluation in this manner for over 20 years, and over that period the measure has performed quite well as a country allocation tool. It had been quite a while since we had empirically analyzed the performances of alternative measures of overvaluation. Still, we could not help but recognize that the question was a good one. So, we rolled up our sleeves and conducted an empirical study to address the question: Which time perspective appears to work best? This paper describes the highlights of our analysis. It presents country-allocation performance data for four different measures of real effective exchange rate (REER) overvaluation: the percentage difference between the REER and its 3-Year moving average, its 6-Year moving average, its 10-Year moving average, and its 20-Year moving average.

After examining results across three universes (global markets, developed markets, and emerging markets) and over three time periods (the past 20 years and its two 10-year sub-periods), our main findings are as follows:
1. The REER vs. its 3-Year moving average (M.A.) is generally the worst performer among the four indicators
2. During the past 20 years (1998-2017) and during the first 10-year sub-period (1998-2007), the 6-Year M.A. was marginally the best indicator in the global and emerging markets universes, but the 20-Year M.A. performed better in the developed markets universe.
3. During the second 10-year sub-period (2008-2017), the 20-Year M.A. showed the best performance, but only modestly so.

The bottom line result appears to be that we would be hesitant to shorten the M.A. length that we currently use in our country allocation model (which is 6 years). If we were to change the M.A. length, we would make it longer, but the evidence for making such a change is not extremely compelling.

REER Overvaluation: Definitions and Performance Evaluation Methodology

A country's REER is a relative price index. We measure Country A's REER index as the ratio of (a) the price of Country A's domestic consumption basket in terms of Country A's currency; to (b) the trade-weighted price of Country A's trading partners' consumption baskets in terms of Country A's currency. Based on this definition, one can identify two stylized examples in which Country A's REER would appreciate:

1. Country A's nominal exchange rate appreciates relative to the trade-weighted basket of its trading partners' currencies, while Country A's domestic inflation rate equals the trade-weighted domestic inflation rate of its trading partners.

2. Country A's nominal exchange rate does not change relative to the trade-weighted basket of its trading partners' currencies, but Country A's domestic inflation rate exceeds the trade-weighted domestic inflation rate of its trading partners.

Large-scale REER appreciation is often associated with deteriorating export competitiveness, because it implies that a country's local prices have increased relative those of its trading partners (when prices of all countries are

measured in terms of a common currency). In addition, large-scale REER appreciation can sometimes serve as a warning signal that a country's domestic economy may be overheating and in danger of a painful correction.

Empirically, our country allocation studies have shown that equity markets have tended to underperform global indexes in countries where REERs have previously appreciated greatly relative to their six-year moving averages. Conversely, equity markets have tended to outperform global indexes in countries where REERs have previously depreciated greatly relative to their six-year moving averages.

To get a handle on the issues involved in choosing the correct time frame for calculating REER overvaluation, the case of Japan may provide an interesting example. Over the past 20 years, Japan's REER has exhibited a pattern that is quite common across global economies. Its REER appears to have both a trend (in Japan's case, a downward trend) and a considerable amount of mean reversion relative to that trend. Because of the apparent downtrend, the degree of Japan's REER undervaluation is greatly affected by the choice of time frame for comparison. As December 29, 2017, the real yen was undervalued by a mere 3% relative to its 3-year moving average. However, it was 11% undervalued relative to its 6-year moving average, 19% undervalued relative to its 10-Year moving average, and 22% undervalued relative to its 20-year moving average.
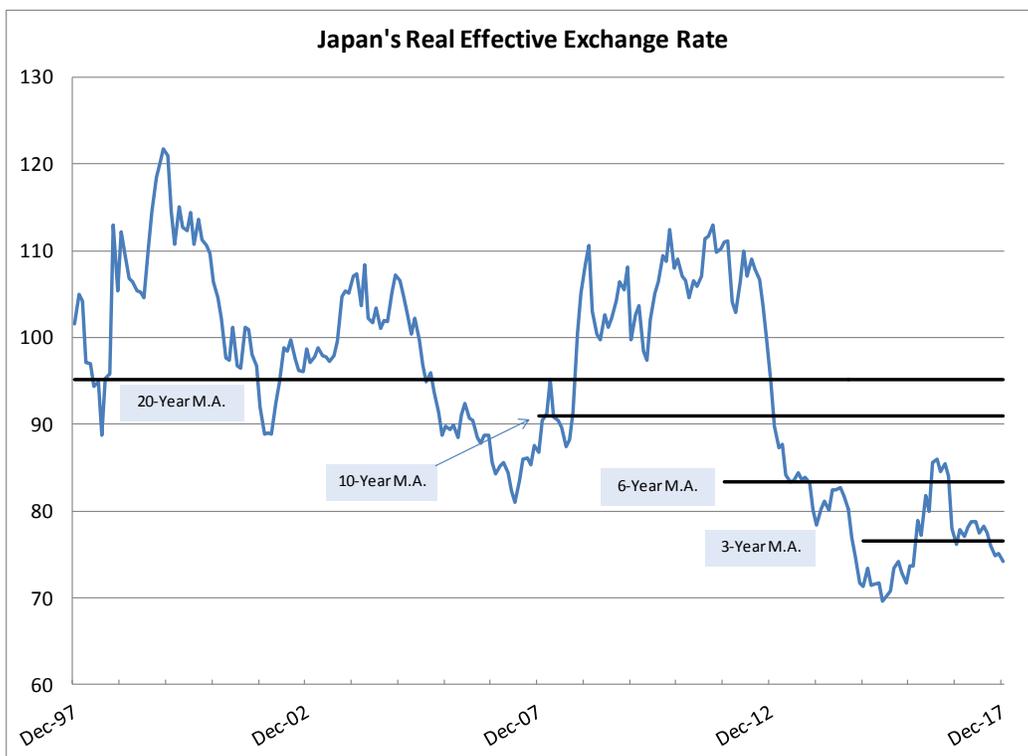
We conducted two types of tests to determine the effectiveness for country allocation our three indicators (which are the percentage difference between the REER and its 3-Year moving average, its 6-Year moving average, its 10-Year moving average, and its 20-Year moving average). The first test was a back-test in which we rebalanced model portfolios away from their benchmarks by underweighting markets with overvalued REERs and overweighting markets with undervalued REERs. Model portfolio overweights were constrained so that small markets would not be unreasonably overweighted and large markets would not be unreasonably underweighted.

The second test was a correlation analysis. We calculated scores each month, such that the most attractive markets (those with the most undervalued REERs) received the highest scores and the most unattractive markets (those with the most overvalued REERs) received the lowest scores. Each month, we calculated the cross-country

correlation between scores and subsequent equity returns. In months when markets with undervalued REERs tended to outperform markets with overvalued REERs, the correlations were positive (and vice-versa). We then examined the time series of these cross-country correlations and calculated two statistics: (1) the frequency of positive correlations (how often did the score provide a signal that pointed investors in the right direction), and (2) the t-Statistic associated with the average correlation (a measure of the statistical significance of the difference between the average correlation and zero).

We conducted the test over three investment universes: MSCI All-Country World (ACWI), MSCI Developed Markets, and MSCI Emerging Markets. The tests were conducted over the last 20 years (1998 – 2017) and over its two 10-year sub-periods (1998-2007 and 2008-2017).

We will first discuss the results over the full 20 years: 1998-2017. Within the MSCI ACWI universe, all four measures performed well within the MSCI ACWI universe. The best performing measure—by a nose—was the REER vs. its 6-Year moving average (M.A.), while the worst performing index was the REER vs. its 3-Year M.A.

Within the MSCI Developed Markets universe, the REER overvaluation measures became stronger as the time perspective broadened. The REER vs. its 3-Year M.A. was weak. The statistics were strong and increasingly so for the REER overvaluation measures based on 6-Year, 10-Year, and 20-Year moving average.

Within the MSCI Emerging Markets universe, the alphas were generally high, but the REER overvaluation measure based on the 6-Year M.A. yielded the highest alpha and statistical significance (as measured by the t-statistic).

Back-Test of Real FX Overvaluation as Stand-Alone Indicator
The Last 20 Years: 1998 - 2017

	MSCI ACWI Universe			
	REER vs. 3-Year M.A.	REER vs. 6-Year M.A.	REER vs. 10-Year M.A.	REER vs. 20-Year M.A.
Annualized Backtest Alpha	3.1%	4.1%	3.5%	3.7%
Frequency of Positive Correlation	56.3%	57.1%	55.0%	57.1%
t-Statistic of Correlations	1.5	2.3	1.8	2.3
	MSCI Developed Market Universe			
	REER vs. 3-Year M.A.	REER vs. 6-Year M.A.	REER vs. 10-Year M.A.	REER vs. 20-Year M.A.
Annualized Backtest Alpha	0.3%	1.0%	1.1%	1.5%
Frequency of Positive Correlation	52.1%	53.8%	55.0%	56.3%
t-Statistic of Correlations	1.0	2.2	2.5	2.8
	MSCI Emerging Markets Universe			
	REER vs. 3-Year M.A.	REER vs. 6-Year M.A.	REER vs. 10-Year M.A.	REER vs. 20-Year M.A.
Annualized Backtest Alpha	3.5%	4.0%	2.5%	3.0%
Frequency of Positive Correlation	52.9%	51.3%	51.3%	55.8%
t-Statistic of Correlations	1.1	1.7	1.0	1.1

Source: Heckman Global Advisors.

We next examined the results over two 10-year sub-periods: 1998 – 2007 and 2008 – 2017. We will first discuss the results over the first 10-year sub-period: 1998-2007. Within the MSCI ACWI universe, all four indicators of REER overvaluation generated substantial alphas during the period, ranging from 5.3% to 7.2%. Moreover, all four indicators (except the REER vs. its 10-Year M.A.) had frequencies of positive correlation that exceeded 55% (which is high, based on our previous experience with these tests). Of the four indicators, the REER vs. its 6-Year M.A. had the highest t-Statistic (and hence statistical significance), although the REER measures based on 10-Year and 20-Year M.A.s were not far behind.

Within the MSCI Developed Markets universe, the REER overvaluation measures became stronger as the time perspective broadened. The REER vs. its 3-Year M.A. was the weakest indicator, and the REER vs. its 20-Year M.A. was the strongest indicator based on all three statistics—alpha, frequency of positive correlation, and statistical significance.

Within the MSCI Emerging Markets universe, the alphas were generally high, with the highest alpha being generated by the measure of REER overvaluation vs. its 6-Year M.A. The 6-Year measure also showed the highest statistical significance. Interestingly, only two of the indicators had frequencies of positive correlation that exceeded 50%: the measure of REER overvaluation vs. its 3-Year M.A. and the measure of REER overvaluation vs. its 20-Year moving average.

Back-Test of Real FX Overvaluation as Stand-Alone Indicator
First 10-Year Period: 1998 - 2007

	MSCI ACWI Universe			
	REER vs. 3-Year M.A.	REER vs. 6-Year M.A.	REER vs. 10-Year M.A.	REER vs. 20-Year M.A.
Annualized Backtest Alpha	5.3%	7.2%	6.0%	6.1%
Frequency of Positive Correlation	57.5%	58.3%	52.5%	56.7%
t-Statistic of Correlations	0.8	1.6	1.2	1.2

	MSCI Developed Market Universe			
	REER vs. 3-Year M.A.	REER vs. 6-Year M.A.	REER vs. 10-Year M.A.	REER vs. 20-Year M.A.
Annualized Backtest Alpha	-0.3%	0.6%	1.1%	1.7%
Frequency of Positive Correlation	45.8%	47.5%	48.3%	52.5%
t-Statistic of Correlations	-0.7	0.3	0.9	1.1

	MSCI Emerging Markets Universe			
	REER vs. 3-Year M.A.	REER vs. 6-Year M.A.	REER vs. 10-Year M.A.	REER vs. 20-Year M.A.
Annualized Backtest Alpha	5.5%	6.2%	3.3%	3.7%
Frequency of Positive Correlation	52.5%	49.2%	47.5%	52.5%
t-Statistic of Correlations	0.8	1.3	0.7	0.3

Source: Heckman Global Advisors.

We will now discuss the results over the second 10-year sub-period: 2008-2017. Within the MSCI ACWI universe, all of the indicators showed modestly positive alphas during the period. In addition, they all had frequencies of positive correlation exceeding 55% and t-Stats that were 1.3 or higher. Of the four indicators, the REER vs. its 20-Year M.A. performed best, but only modestly better than the REER vs. its 6-Year M.A.

Within the MSCI Developed Markets universe, the four measures of REER overvaluation had remarkably similar performances based on all three statistics: alpha, frequency of positive correlation, and statistical significance.

Within the MSCI Emerging Markets universe, the four indicators' performances were again remarkably similar. The measure of REER overvaluation against its 20-Year M.A. had the higher values across all three statistics, but only modestly so.
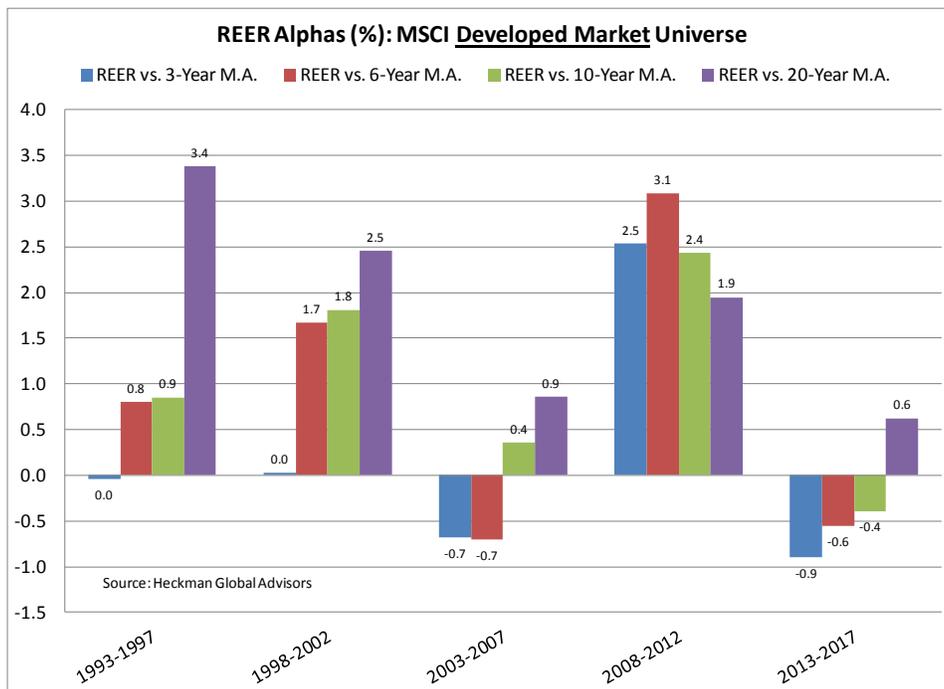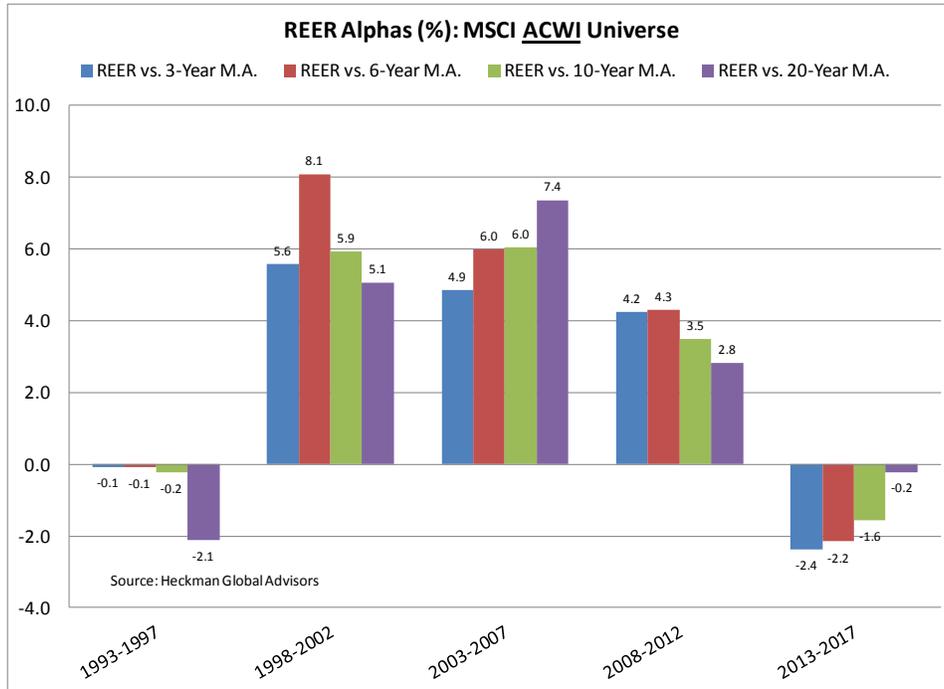
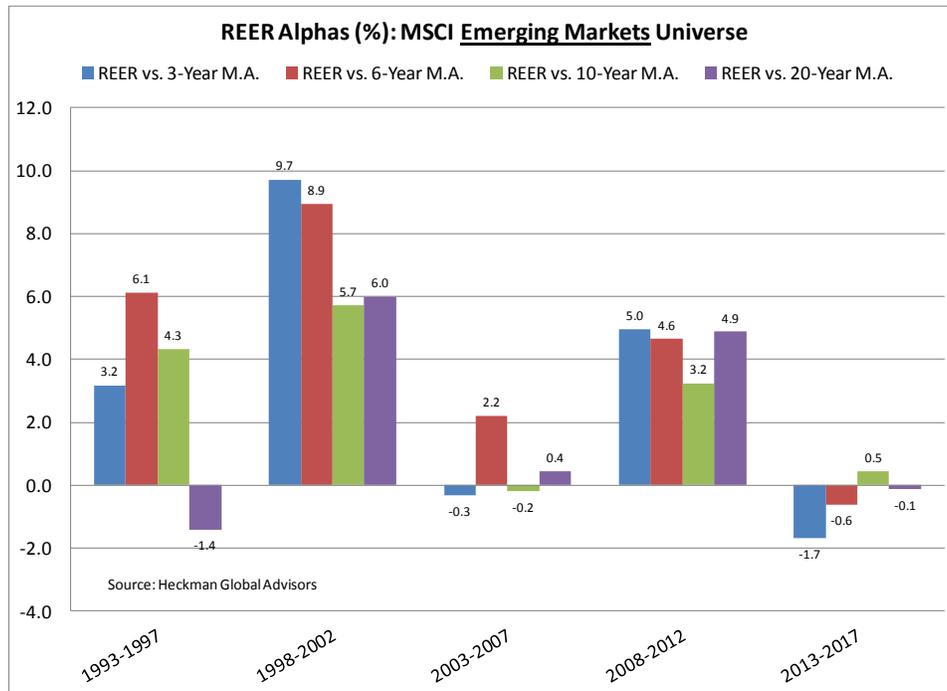**Back-Test of Real FX Overvaluation as Stand-Alone Indicator**
Second 10-Year Period: 2008 - 2017

	MSCI ACWI Universe			
	REER vs. 3-Year M.A.	REER vs. 6-Year M.A.	REER vs. 10-Year M.A.	REER vs. 20-Year M.A.
Annualized Backtest Alpha	1.1%	1.2%	1.1%	1.4%
Frequency of Positive Correlation	55.0%	55.8%	57.5%	57.5%
t-Statistic of Correlations	1.3	1.6	1.3	2.2
	MSCI Developed Market Universe			
	REER vs. 3-Year M.A.	REER vs. 6-Year M.A.	REER vs. 10-Year M.A.	REER vs. 20-Year M.A.
Annualized Backtest Alpha	0.9%	1.4%	1.1%	1.3%
Frequency of Positive Correlation	58.3%	60.0%	61.7%	60.0%
t-Statistic of Correlations	2.3	2.9	2.7	3.0
	MSCI Emerging Markets Universe			
	REER vs. 3-Year M.A.	REER vs. 6-Year M.A.	REER vs. 10-Year M.A.	REER vs. 20-Year M.A.
Annualized Backtest Alpha	1.7%	2.1%	1.9%	2.4%
Frequency of Positive Correlation	53.3%	53.3%	55.0%	59.2%
t-Statistic of Correlations	0.8	1.1	0.7	1.3

Source: Heckman Global Advisors.

Appendix: 5-Year Alphas of REER Overvaluation Indicators

REER Alphas (%): MSCI ACWI Universe

■ REER vs. 3-Year M.A.   ■ REER vs. 6-Year M.A.   ■ REER vs. 10-Year M.A.   ■ REER vs. 20-Year M.A.

Source: Heckman Global Advisors

Period	REER vs. 3-Year M.A.	REER vs. 6-Year M.A.	REER vs. 10-Year M.A.	REER vs. 20-Year M.A.
1993-1997	-0.1	-0.1	-0.2	-2.1
1998-2002	5.6	8.1	5.9	5.1
2003-2007	4.9	6.0	6.0	7.4
2008-2012	4.2	4.3	3.5	2.8
2013-2017	-2.4	-2.2	-1.6	-0.2

REER Alphas (%): MSCI Developed Market Universe

■ REER vs. 3-Year M.A.   ■ REER vs. 6-Year M.A.   ■ REER vs. 10-Year M.A.   ■ REER vs. 20-Year M.A.

Source: Heckman Global Advisors

Period	REER vs. 3-Year M.A.	REER vs. 6-Year M.A.	REER vs. 10-Year M.A.	REER vs. 20-Year M.A.
1993-1997	0.0	0.8	0.9	3.4
1998-2002	0.0	1.7	1.8	2.5
2003-2007	-0.7	-0.7	0.4	0.9
2008-2012	2.5	3.1	2.4	1.9
2013-2017	-0.9	-0.6	-0.4	0.6

REER Alphas (%): MSCI Emerging Markets Universe

Source: Heckman Global Advisors

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