ONE SIZE DOES NOT FIT ALL

Understanding Factor Investing

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EXECUTIVE SUMMARY

The size premium has been widely used in asset allocation and in risk models for decades. However, some academics and practitioners have refuted the validity of the size premium. They argue 1) the size premium has disappeared in the last 20 years and no longer exists; 2) the size premium exists only in the United States and not in other markets; 3) the size premium disappears after filtering out smaller stocks for investability.

In this paper, we measured the size premium as the excess return earned by smaller companies over the market. Based on data starting from 1998, our analysis validated that the size premium has persisted in the U.S. as well as in non-U.S. markets. We also confirmed that the size premium does not disappear after investability constraints are applied. MSCI's Investable Market Indexes preserve the size premium. In fact, we observe that liquidity and investment capacity of size portfolios are considerably compromised beyond the Investable Market Index universe.

There has been a lot of research on the existence of the size premium but less on the practical implementation of this premium. In this paper, we take our research one step further by analyzing several ways in which size can be reflected in a portfolio. Market cap-weighted indexes, such as the MSCI World Small Cap Index, remain effective and investable ways of representing the size premium. Our analysis further suggests that a "sweet spot" along the all-cap spectrum exists that capitalizes on the mid-cap and low size factors. Investors can use this insight to construct "smarter" size-based portfolios.

For every size-based strategy, however, there is a trade-off between factor exposure and investability. As a result, investors who wish to take advantage of the size factors should weigh the benefits of each strategy as no one size fits all.

INTRODUCTION

The size premium can be defined as the tendency of smaller companies to earn a higher return than larger firms over a long period. The size premium has been an integral part of the investment process for decades and has been extensively used in asset allocation and in risk models. In the last decade, the size premium has become the building block of several factor-based indexes, which have represented this persistent phenomenon in a rules-based and transparent fashion.

The most popular explanation for the existence of the size premium is that the size of a firm (by market capitalization) is a proxy of its riskiness and, in general, smaller companies tend to have higher risk than their larger counterparts. As a result, investors require higher returns to take on this additional risk. Banz (1981) was one of the first to discover that firm size has explanatory power. However, the research on size took off only after Fama and French (1992) included size as a key component in their three-factor model. Subsequently, many other studies found the persistence of the size effect across markets.

More recently, the size factor has become controversial in academic research. There has been much debate as to whether the size premium has diminished or, in some cases, altogether vanished. Also, some argue that the size effect does not exist outside the U.S.

This paper is the sixth and last in a series exploring each of the six key factors that have historically offered positive long-term excess returns: value, quality, momentum, yield, low volatility and low size. In this paper, we address the following questions:

1. What is size investing?
2. Does the size premium exist today and what are the characteristics of size-based portfolios?
3. How can we implement size-based investing?

WHAT IS SIZE INVESTING?

The size effect reflects excess returns of smaller companies (by market capitalization) relative to their larger counterparts. Research studies have focused on the underlying sources of risk that are associated with investing in smaller companies. Some researchers make the point that firm size is a proxy for the multiple risk factors by which a stock is driven. Some argue that the size premium is a reward for taking on liquidity risk. Others argue the size premium is attributable to investor behavior because of the limited information available on smaller companies. Following are some of the main reasons for the size effect described by researchers:

1) **Firm size as a proxy of risk:** Fama and French (1992) concluded that firm size and book value are proxies to underlying risk factors in stock returns. Chan and Chen (1991) argued that firms that are smaller in size are like "fallen angels" that have dropped in price because of poor performance. Dichev (1998) and Vassalou and Xing (2004) concluded that the size effect is driven by default risk.

2) **Liquidity risk:** Smaller companies tend to have lower liquidity; this liquidity risk has led to higher returns. Amihud (2002) finds that the returns of smaller firms are sensitive to variation in market liquidity over time. Pastor and Strambaugh (2003) established that systematic liquidity risk is an important component of underlying risk for small-cap companies. However, this relationship is not straightforward. Liu (2006) shows that market liquidity is powerful in explaining returns and that the size premium might not exist if liquidity is excluded as one of the explanatory factors.

3) **Investor behavior:** The size effect could arise from the lack of information on smaller firms. Merton (1987) argued that stocks that were less widely covered by analysts tended to generate higher returns. Hou and Moskowitz (2005) showed that a delayed investor reaction could have a significant effect on returns. They proposed that price delays could have a significant impact on U.S. stock returns; this impact captures a significant portion of the size premium.

4) **Seasonality:** Research on the "January effect" showed that the size effect existed only in January and was minimal in following months. For example, Keim (1983) concluded that a significant component of the size premium is realized in the first few days of January. Daniel and Titman (1997) found a strong pattern between the small-cap premium in U.S. stocks and the January effect. Some explained that tax-loss harvesting — where investors sell poor-performing stocks at year-end only to repurchase them in the new year resulted in a January rebound in stock prices. Others suggested that "window-dressing" — where investors buy winners and sell losers at the end of the year for portfolio optics — affected small-cap stock prices.

5) **Data mining:** Some skeptics argue that the size effect exists because of data mining. They note that only the most successful results have been widely discussed and results that do not show the existence of size have largely been ignored. Lo and MacKinlay (1990) and Black (1993) observed that the sample universe that forms the basis of all research has been the same and the size premium has been inconsistent over time. However, there is no data to conclude that the size premium does *not* exist.

Exhibit 1 provides a summary of key research that has been conducted on the size premium in the U.S.

Exhibit 1: Key Academic Research on the Size Premium in the U.S.

Author	Summary	Notes
Banz (1981)	First to discover the size effect in the U.S.	• Analyzed stocks listed on the NYSE. • Smaller firms tend to have higher returns than larger firms. • Investors do not want to hold smaller stocks because of lack of information leading to higher stock returns.
Brown et al. (1983)	Found a linear relationship between average daily returns of 10 size-based portfolios and the log of average market cap of the portfolios.	• Analyzed stocks listed on NYSE and AMEX. • Used the same data set as Reinganum – 566 stocks but over a longer sample period of 1967 to 1979.
Fama and French (1992)	Size has significant explanatory power along with book-to-market.	• Analyzed stocks listed on NYSE, AMEX and NASDAQ. • Beta alone cannot explain underlying returns.
Keim (1993)	Observed the January effect in small caps.	• Analyzed stocks listed on NYSE and AMEX. • The size effect is most pronounced in January compared to other months.

The size effect outside the U.S. has been less well researched. Skeptics argue that to validate the existence of the size premium, samples outside the U.S. should be tested. This would corroborate that the size effect is prevalent in other markets in spite of different trading mechanisms, investor behavior and general market infrastructure.

To validate that size premium has an explanation other than data mining, several researchers have attempted to study the size premium in non-U.S. markets. Levis (1985) and Mills and Jordanov (2000) studied the size effect in stocks listed on the London Stock Exchange and found that the average returns of small firms exceeded those of larger firms. Wahlroos and Berblund (1986) used Fama-Macbeth regressions to conclude that the risk-adjusted returns of small-cap stocks listed on the Helsinki Stock Exchange were higher than those of large-cap Finnish stocks. Exhibit 2 summarizes key research conducted on size in non-U.S. markets.

Exhibit 2: Key Academic Research on the Size Premium in Non-U.S. Markets

Author	Summary	Notes
Levis (1985)	Observed that size effect exists in stocks listed on the London Stock Exchange.	• Analyzed all stocks listed on the LSE. • Smaller firms outperformed larger firms. • However, smaller firms had a lower beta, therefore were less risky than larger firms.
Wahlroos and Berblund (1986)	Examined the size effect in stocks listed on the Helsinki Stock Exchange.	• Analyzed all stocks listed on the HSE. • Used Fama-Macbeth cross-sectional regression to conclude that risk-adjusted mean annual returns of small-cap portfolios were higher than those of large-cap portfolios.
Elfakhani et al. (1998)	Observed the size effect in Canada.	• Analyzed 2,000 stocks listed on the Toronto and Montreal stock exchanges. • Found that average stock returns decrease with the increase in company market cap.
Rouwenhorst (1999)	Observed the size effect in emerging markets.	• Analyzed 1,700 firms in more than 20 countries. • Like developed markets, emerging markets stocks exhibit momentum, size effect and value effect.

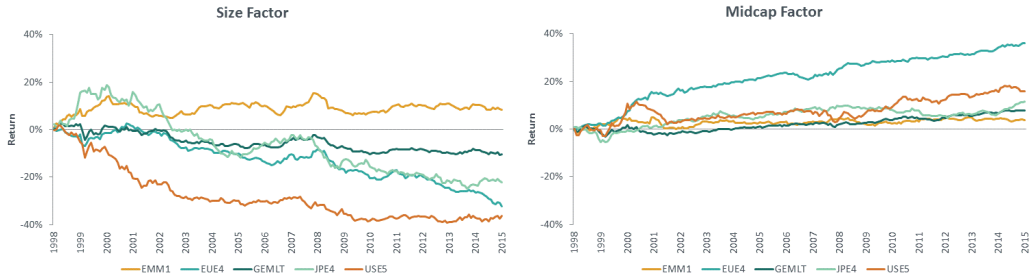
TESTING THE EXISTENCE OF THE SIZE EFFECT

Size as a systematic risk factor has long been an important component in fundamental factor models. In the MSCI Global Equity Total Market Model, there are two style factors that represent different dimensions of size, namely 1) the size factor, and 2) the mid-capitalization factor. The size factor[1] captures the return differences between large-cap stocks and small-cap stocks. The mid-cap factor [2]captures the characteristics of a "barbell portfolio" that is long mid-cap stocks and short small-cap stocks. Exhibit 3 shows the pure returns of these factors across different regions using MSCI's factor models. In general, low size and mid-cap factors were rewarded across regions. In the left chart, a negative return of the Size factor implies that small-cap stocks have outperformed large-cap stocks.

[1] Size factor is measured by the log of market capitalization.

[2] Mid-capitalization factor is based on the cube of size exposure. It is orthogonalized with respect to Size.

Exhibit 3: Pure Factor Returns: Size and Mid-Capitalization[3]



However, pure factor portfolios such as those used in the fundamental risk models are, by, design, long/short portfolios. Some critics maintain that the size premium disappears when investability is taken into account, i.e., by eliminating very small stocks that are not readily tradeable or lack adequate capacity for institutional investment.

To validate the robustness of the size premium of investable portfolios, we conducted a test on two universes of U.S. stocks — one representing the entire U.S. listed market and the other representing a subset of the entire market that has been screened for liquidity and investment capacity.[4] If the size premium remains in this screened investable market, we will establish that the premium is robust.

Here are the steps we followed:

1) **Test the U.S. market by analyzing two universes**

    a. The entire listed market: The U.S. listed universe, which consists of about 4,000 stocks that trade on NYSE, NASDAQ and AMEX stock exchanges.

    b. The investable market: MSCI USA Investable Market Index (USA IMI) universe, which consists of about 2,500 stocks and forms the basis of an investable portfolio that consists of large-, mid- and small-cap stocks. The universe adheres to MSCI's Global Investable Market Indexes methodology.

2) **Perform decile analysis on each universe.** Deciling is a statistical method of splitting up a set of ranked data into 10 equal subsets in order to understand the characteristics of each group. In this case, it is used to test whether the size premium exists in each universe; if it does, decile portfolios with smaller stocks

[3] EMM1: Barra Emerging Markets Model, EU4: Barra European Equity Model, GEMLT: Barra Global Total Market Equity Model for Long-Term Investors, JPE4: Barra Japan Equity Model, USE5: Barra US Total Market Model.

[4] Based on live data from December 1998 to December 2015.

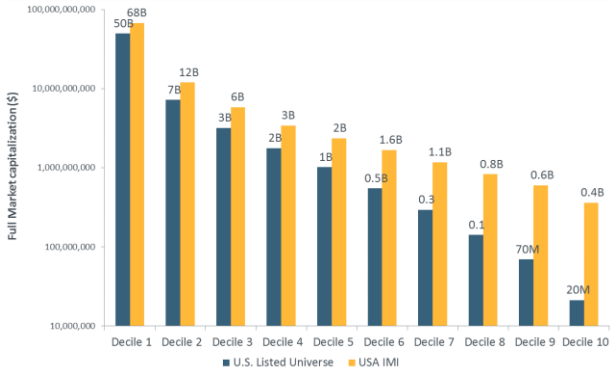
should outperform decile portfolio with larger stocks. To construct decile portfolios based on size, we sorted the two universes by full market cap and then divided each of them into 10 groups. Stocks within each decile are equally weighted and rebalanced monthly.

3) **Verify that smallest deciles outperform largest deciles:** As discussed, we tested a pattern that smaller stocks commanded a premium over their larger counterparts.
4) **Examine investability** (liquidity and investment capacity) of smallest deciles.
5) **Examine characteristics of decile portfolios** using the MSCI Global Equity Model (GEMLT[5] model).
6) **Conduct a similar analysis on non-U.S. markets** using the MSCI World ex USA IMI.

SIZE PREMIUM IN THE U.S.

Before testing the performance of deciles in the two universes, we compared the average size of assets in the USA IMI deciles to the U.S. listed universe deciles. Given its investability constraints, the USA IMI universe selected larger assets on average than the U.S. listed universe: The average market capitalization of a company in *decile 10* of the USA IMI was approximately $400 million, in between the average size of a company in *decile 6* and *decile 7* of the U.S. listed universe.

Exhibit 4: Average Market Capitalization

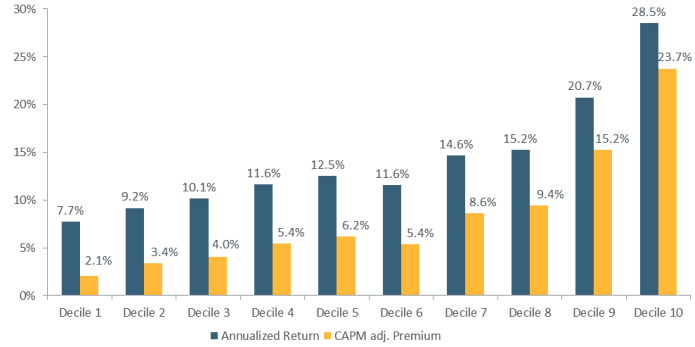


Data as of December 2015

[5] The new model introduces innovations from MSCI for building multi-factor equity models, including new Systematic Equity Strategies (SES) factors, advances on descriptor research and the alignment of factor structure with investment horizon.

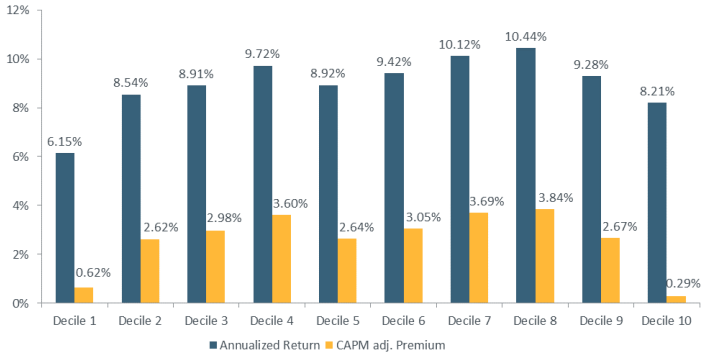
In Exhibit 5 and 6, we plotted returns for decile portfolios for both universes from 1998 to 2015. Both annualized returns as well as returns in excess of those estimated by the Capital Asset Pricing Model (CAPM) are shown. In the CAPM-adjusted premium shown below, the portion of return due to the systematic market risk of similarly sized companies is removed from the premium. By doing this, we are able to isolate the return due to factors (including size) other than the market. The decile analysis confirms that, in general, smaller stocks outperformed larger stocks during this time period and that the premium was preserved in the USA IMI.

Exhibit 5: Size Premium in the U.S. Listed Universe[6]



Returns from December 1998 to December 2015

Exhibit 6: Size Premium in MSCI USA IMI



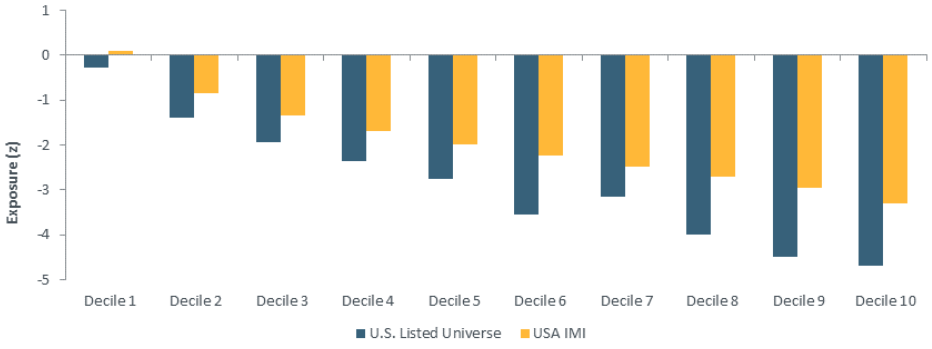
Returns from December 1998 to December 2015

[6] For the calculation of returns of decile 10 of the U.S. Listed universe, only stocks with a price >$1 were selected in order to keep the returns meaningful.

The U.S. listed universe demonstrated a significant increase in returns in the bottom deciles — especially in deciles 9 and 10. The USA IMI, however, revealed a slightly different pattern where the bottom deciles suggested a performance cliff after decile 8. Could this suggest that the size premium diminishes once investability screens are applied? We investigated this pattern later in this paper and found other factors caused the performance drag; the size premium, in fact, was preserved.

As a robustness check, we analyzed the exposure of each decile to the size factor. Exhibit 7 shows that for both the U.S. listed universe and the USA IMI, with each increasing decile the negative exposure to the size factor increases (meaning that the signal to low size becomes stronger as we move to subsequent deciles). Also, the signal to the low size factor is stronger in the bottom deciles of the U.S. listed universe than in the USA IMI universe because the USA IMI consists of larger assets.

Exhibit 7: Average Size Exposure



Monthly exposures from January 1999 to December 2015 using GEMLT

We have confirmed that, in general, deciles with smaller stocks outperformed their larger counterparts and showed a stronger signal to low size. In addition, the U.S. listed universe has, on average, smaller companies than the USA IMI and the bottom deciles demonstrated higher returns and stronger signals than the corresponding deciles in the USA IMI.

But can investors realize the returns of the bottom deciles of the U.S listed market in the real world? Or, are the bottom deciles not investable and as a result should investors limit their portfolios to the USA IMI? To answer these questions, we compare the investability of the bottom deciles of both universes.

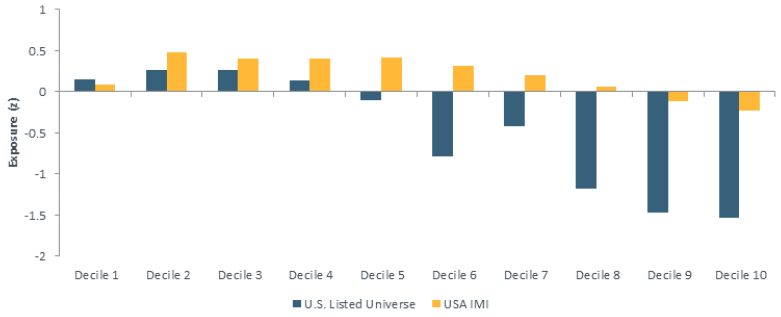
INVESTABILITY OF BOTTOM DECILES

Two crucial yet quantifiable metrics to measure whether an investment theme can be practically implemented are a portfolio's liquidity and investment capacity. These metrics are critical for institutional investors seeking to make sizeable allocations to any strategy.

Analyzing the liquidity confirms whether the portfolio can be traded in a reasonable time frame and at a reasonable cost whereas analyzing the investment capacity confirms whether the portfolio can handle a large amount of investment. In Exhibit 8, we analyze liquidity, which is the first metric to measure investability of a portfolio. We use liquidity exposures of the U.S listed universe and the USA IMI universe, focusing on the bottom deciles.[7]

We found that the USA IMI preserved its liquidity whereas the U.S. listed universe's liquidity dropped off significantly starting from decile 6. This stark difference in liquidity profiles highlights the importance of constructing portfolios that have a relatively strong exposure to low size but at the same time can be traded readily.

Exhibit 8: Liquidity in USA IMI and U.S. Listed Universe



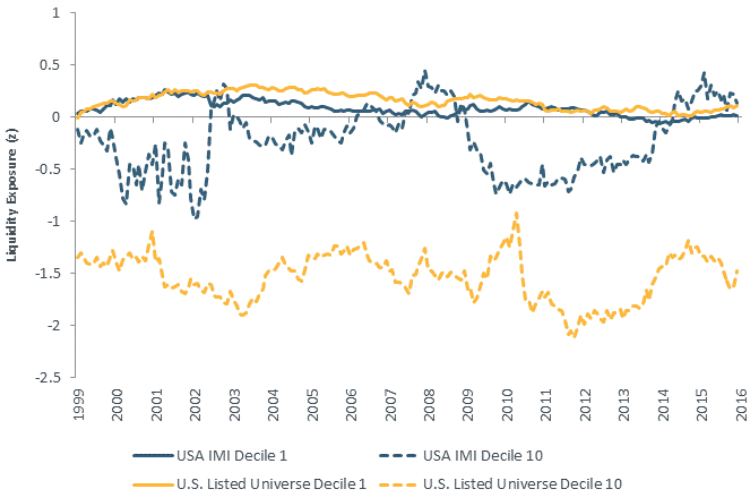
Monthly exposures from January 1999 to December 2015 using GEMLT

The test of liquid portfolios is how they behave in a downturn. In Exhibit 9, we analyze the liquidity profiles of the bottom deciles through downturns such as the bursting of the tech bubble and the global financial crisis. The top deciles of both universes (solid lines) remained stable through the crisis. Once again, there was a significant difference in the liquidity of the bottom deciles of the two universes (dotted lines): Decile 10 of the U.S listed universe revealed very poor liquidity over time whereas decile 10 of the IMI remained fairly liquid

[7] The liquidity factor in GEMLT describes the return differences due to relative trading activity. The descriptors of this factor are based on the fraction of total shares outstanding that trade over a recent window. It is calculated using ATVR (Annual Traded Value Ratio) and monthly, quarterly and annual share turnover.

(though the latter did decline in liquidity during crisis periods, illustrating why investors command a premium for investing in small-cap stocks.)

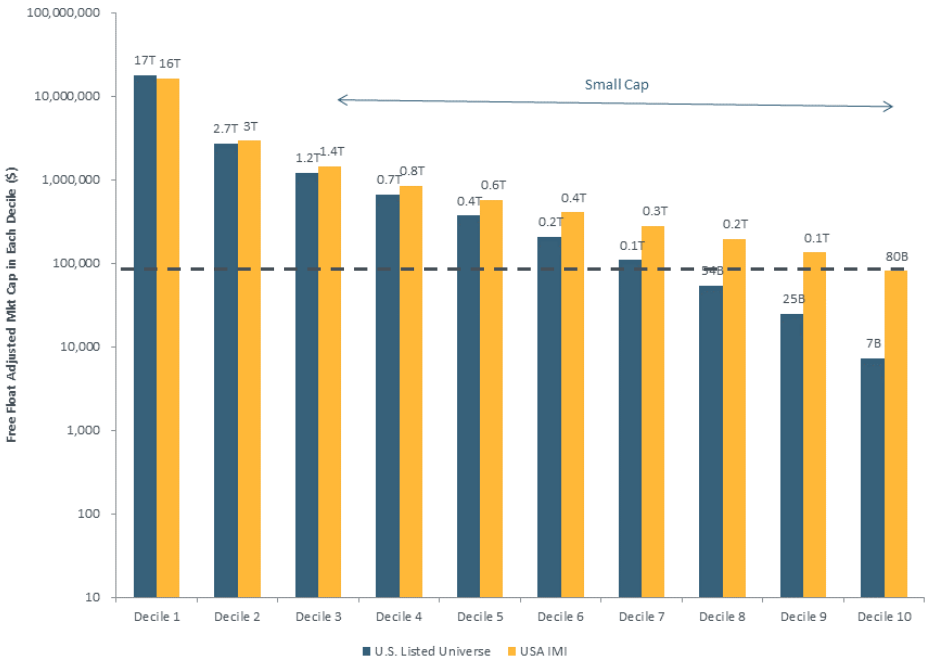
Exhibit 9: Time Series of Liquidity in USA IMI and U.S. Listed Universe



Monthly exposures from January 1999 to December 2015 using GEMLT

The second metric that is important in measuring investability is the investment capacity of a portfolio. Exhibit 10 shows a comparison in the investment capacity (as measured by the float-adjusted market capitalization) of the bottom deciles of the U.S. listed universe and the USA IMI. USA IMI's decile 10 has a similar capacity to that of decile 7 of the U.S. listed universe, as shown by the dotted line. The investment capacity of the U.S. listed universe dropped off quickly after decile 7 whereas that of the IMI follows a consistent and gradual pattern. Note: Decile 10 of the U.S. listed universe has only 10% of the capacity of decile 10 of the USA IMI.

Exhibit 10: Investment Capacity of USA IMI and U.S. Listed Universe[8]



Market caps as of December 2015

Even though the bottom deciles beyond the IMI have shown higher returns and a stronger signal to low size, there are practical challenges such as poor liquidity and investment capacity that can prevent investors from implementing these portfolios. The USA IMI provided balance between strength of factor signal and investability.

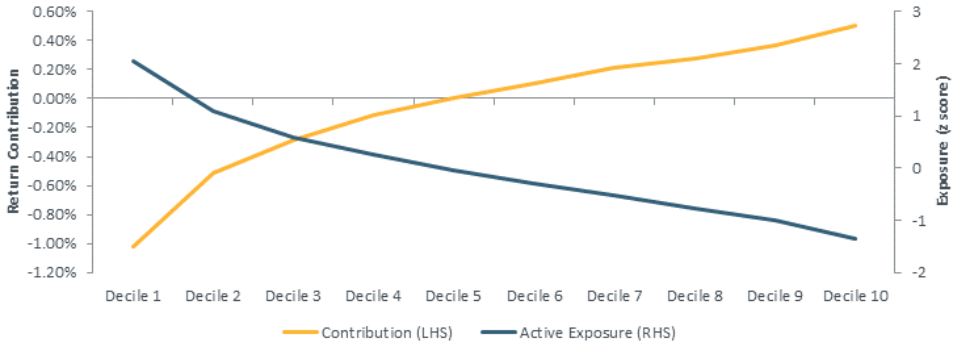
THE USA IMI FABRIC

Previously, we observed that the USA IMI preserves the size premium but the performance of the bottom deciles tapers off. We investigated this further to understand the role that the size factor plays in the performance of each decile. Exhibit 11 shows the contribution of the size factor to the active return of each decile of the USA IMI as measured against the USA IMI Equal Weighted index. Starting from about decile 4, as the exposure to the size factor

[8] The vertical scale is logarithmic.

decreases (that is, as exposure to small-cap stocks increases), we see size contributing positively to performance.

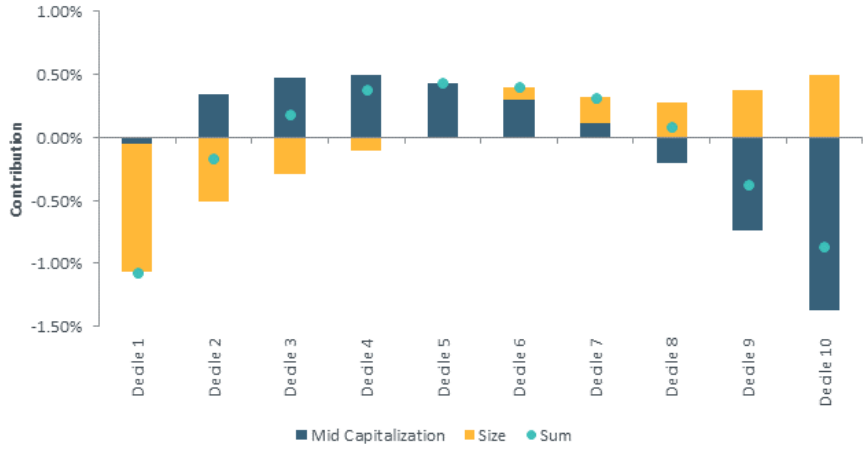
Exhibit 11: USA IMI: Size Capture



Data from December 1998 to December 2015

In addition to the size factor, the mid-capitalization factor contributed significantly to the performance of the deciles (Exhibit 12). By summing up the contribution of these two dimensions of size, we found a sweet spot from decile 3 to decile 7 where the combined contribution is positive.

Exhibit 12: USA IMI: Size Factor + Mid-capitalization Factor = Sweet Spot

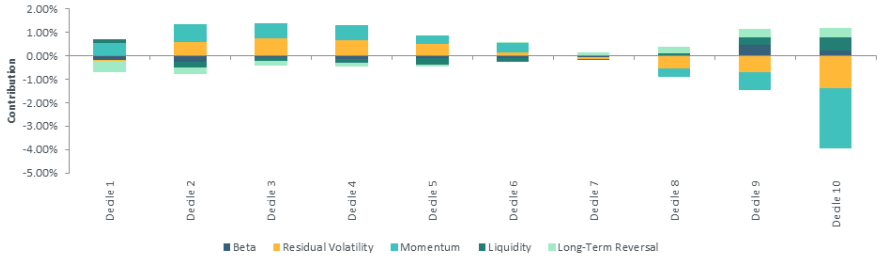


Data from December 1998 to December 2015

Since the size factor has contributed positively to the lower deciles of the USA IMI, we looked at the role other style factors played in creating the performance cliff of the USA IMI

in the bottom deciles. In Exhibit 13, negative momentum (caused by stock price increases reversing course) caused a considerable drag in performance in the bottom deciles, especially deciles 9 and 10. A detailed turnover analysis revealed that about 10%-15% of the assets in decile 10 come from decile 9 as these assets experienced price declines, explaining the influence of negative momentum. On the other hand, the majority of the assets in decile 10 remained in decile 10 and very few assets graduated from the micro-cap (companies outside of the IMI Universe). Residual volatility (returns associated with high-volatility stocks not captured by the beta factor) also caused a drag on the bottom deciles, highlighting the specific risk small caps carry.

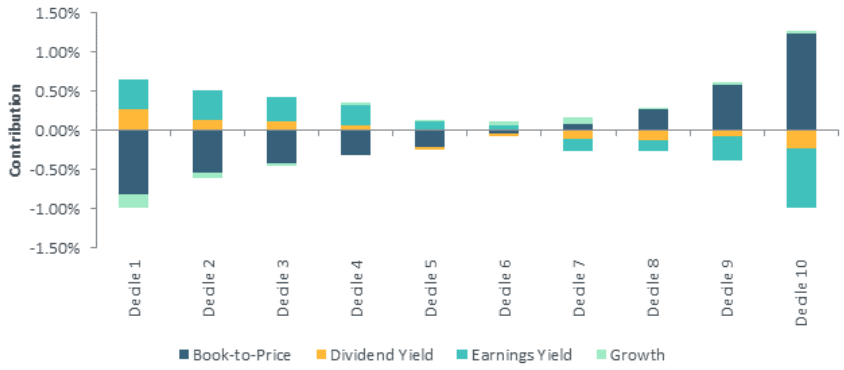
Exhibit 13: USA IMI: Technical Factor Contributions



Data from December 1998 to December 2015

Looking at value factors in Exhibit 14, we found that Book-to-Price has been a big contributor to returns as the size of a portfolio decreases. Earnings yield caused the biggest drag in performance of the bottom deciles.

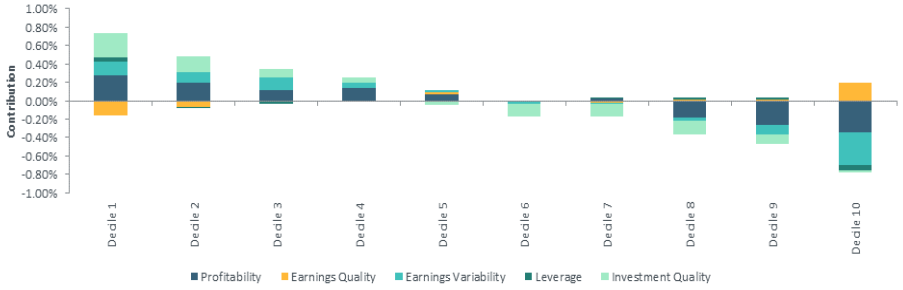
Exhibit 14: USA IMI: Value Factor Contributions



Data from December 1998 to December 2015

In Exhibit 15, profitability and earnings variability contributed negatively to the returns of the bottom deciles.

Exhibit 15: USA IMI: Quality Factor Contributions[9]



Data from December 1998 to December 2015

As we saw, the return contribution from low size increases with every decile and the size premium was preserved in the USA IMI. However, other factors — namely momentum, residual volatility, earnings yield, profitability and earnings variability — caused the performance drag in the lower size deciles.

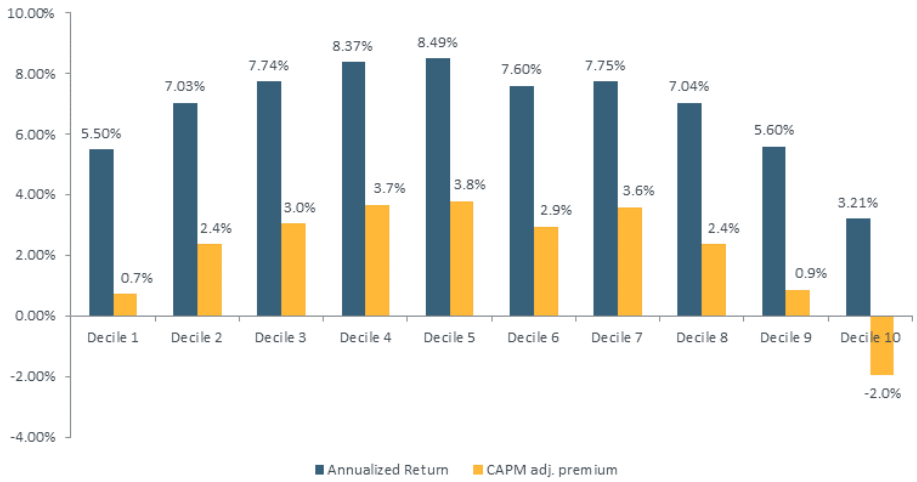
Previously unexplored, this insight can help institutional investors seeking to invest across the all-cap spectrum. Investors can focus on the sweet spot from decile 3-7 to capitalize on both low size and mid cap factors. Investors can create "smarter" size-based portfolios by controlling for unintended factor bets that may be imbedded in lower size deciles.

[9] For further analysis on controlling small caps for quality characteristics, please see Rao, A. (2016). "Tilting to U.S. Small Caps." MSCI Market Insight.

SIZE PREMIUM IN NON-U.S. MARKETS

Some researchers argue that size premium does not exist outside the U.S. To test whether premium exists in non-U.S. markets, we applied the same decile framework on the MSCI World ex USA IMI universe.

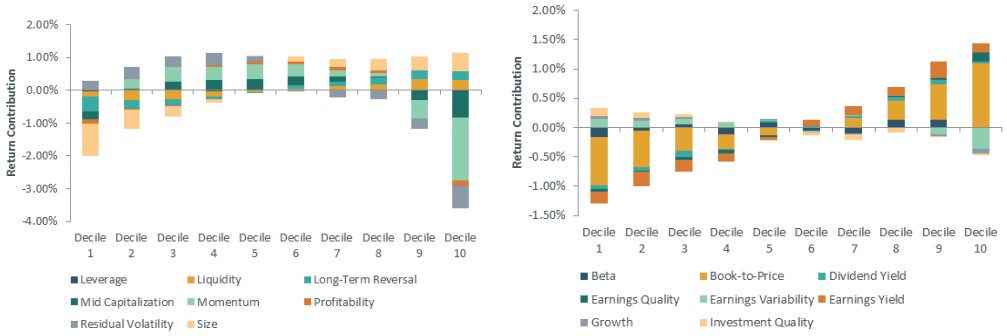
Exhibit 16: Size Premium in Non-U.S. Markets: MSCI World ex USA IMI



Data from December 1998 to December 2015

Exhibit 16 shows the distribution of returns across the non-U.S. all cap spectrum using MSCI World ex USA IMI as a proxy. We see a similar trend to the USA IMI here: The size premium is preserved except in decile 10. We analyzed decile 10 in greater detail and show how exposure to other style factors dragged down performance. Exhibit 17 shows the active return contribution of several style factors using the MSCI World ex USA IMI Equal Weighted Index as a benchmark.

Exhibit 17: MSCI World ex USA IMI: Factor Contribution



Data from December 1998 to December 2015

As in the case of the USA IMI, the contribution from low size increased with each decile. Value, as measured by book-to-price, remained a strong contributor to active returns. Similarly, negative momentum put a significant drag on the performance of the bottom deciles followed by residual volatility.

We have demonstrated that the size premium does exist in global markets. Institutional investors can seek to enhance portfolio attributes by controlling unintended bets in the lower size deciles. In addition, just like in the U.S., there is a sweet spot in the all-cap spectrum in non-U.S. markets.

IMPLEMENTATION OF SIZE-BASED STRATEGIES

While analyzing the existence of the size premium is crucial, it is equally important to evaluate practical ways in which this premium can be implemented. There are multiple ways to harvest the size effect. Using a range of MSCI size indexes, we analyzed the effectiveness of these different strategies. Exhibit 18 shows their risk-return profiles.

Exhibit 18: Key Metrics of Low Size Strategies[10]

	MSCI World Index	MSCI World Small CAP Index	MSCI World Equal Weighted Index	MSCI World Mid CAP Index	MSCI World Mid CAP Equal Weighted Index	MSCI World Size Tilt Index	MSCI World Adaptive Capped 2 0x Index
Total Return* (%)	4.6	8.8	7.4	7.2	7.5	6.1	6.0
Total Risk (%)	15.6	17.7	16.8	17.1	16.7	15.9	16.0
Return/Risk	0.29	0.50	0.44	0.42	0.45	0.38	0.38
Sharpe Ratio	0.15	0.37	0.31	0.29	0.31	0.24	0.23
Active Return (%)	0.0	4.2	2.9	2.7	3.0	1.5	1.4
Tracking Error (%)	0.0	6.9	4.8	5.0	5.1	2.5	2.6
Information Ratio	NaN	0.62	0.60	0.53	0.59	0.60	0.55
Historical Beta	1.00	1.05	1.03	1.05	1.02	1.01	1.02
Turnover** (%)	3.0	14.8	17.1	16.8	31.2	11.5	11.5

Period: 31-Dec-1998 to 31-Dec-2015

* Gross returns annualized in USD

While all strategies presented outperformed the MSCI World Index during the sample period, a plain vanilla small-cap portfolio as represented by the MSCI World Small Cap Index provided the highest Sharpe ratio with a reasonable turnover relative to other indexes. All of the strategies have consistent information ratios, reflecting consistency in generating excess returns. We used the same decile approach employed earlier to understand why the MSCI World Small Cap Index outperformed its peers. Exhibit 19 shows the deciles that each index overweighted and underweighted against the MSCI World IMI index.

[10] The MSCI World Small Cap has been simulated back to 1998 using the MSCI GIMI methodology.

The MSCI Size Tilt Indexes aim to reflect the performance of a Low Size Strategy with high investment capacity. The MSCI Size Tilt Indexes are created by including all the constituents in the Parent Index (defined below) and weighting the constituents using the square root of their market capitalization weight.

The MSCI World Adaptive Capped 2.0 Index allows clients to rely on an adaptive capping mechanism instead of using a pre-defined fixed capping level (such as a maximum weight per constituent). The capping level in these indexes is a function of a client-defined "maximum multiple" that directly limits the `overweight' of the smaller sized constituents.

Exhibit 19: Decile Overweight/underweight vs MSCI World IMI Index

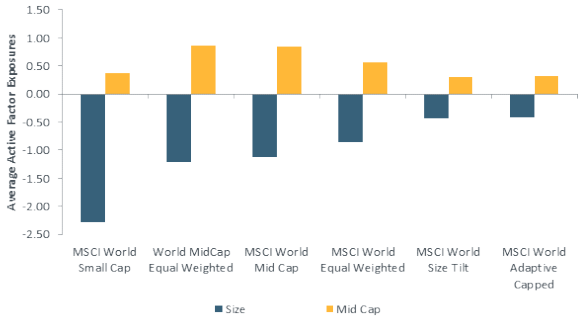
	MSCI World Small Cap	MSCI World Equal Weighted	MSCI World Mid Cap	World Mid Cap Equal Weighted	MSCI World Size Tilt	MSCI World Adaptive Capping
Decile 1	-69.6%	-32.7%	-59.6%	-65.4%	-10.7%	-9.4%
Decile 2	-11.0%	22.6%	48.5%	34.2%	14.1%	16.6%
Decile 3	15.8%	13.1%	16.5%	28.1%	4.1%	1.7%
Decile 4	19.6%	3.0%	1.0%	8.4%	-1.0%	-2.1%
Decile 5	15.7%	-1.6%	-2.0%	-0.8%	-2.1%	-2.3%
Decile 6	10.8%	-1.6%	-1.6%	-1.6%	-1.6%	-1.6%
Decile 7	7.5%	-1.1%	-1.1%	-1.1%	-1.1%	-1.1%
Decile 8	5.2%	-0.8%	-0.8%	-0.8%	-0.8%	-0.8%
Decile 9	3.7%	-0.6%	-0.6%	-0.6%	-0.6%	-0.6%
Decile 10	2.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%

Average weights from 2008 - 2015

First, all strategies displayed various degrees of underweight in decile 1. Second, compared to other size strategies, the plain vanilla MSCI World Small Cap Index displayed a markedly different exposure to the other market capitalization deciles, i.e., large overweights in decile 3 to 7. It is apparent that the outperformance of the MSCI World Small Cap Index was largely attributed to the fact that the index capitalized on the "sweet spot" of deciles 3 to 7. The MSCI World Mid Cap Index and MSCI World Mid Cap Equal Weighted Index also took advantage of the sweet spot to a certain extent, which explains their superior performance relative to other indexes that didn't overweight these deciles.

We further examined the strength of signal to low size for each strategy as measured by average factor exposure (Exhibit 20). All strategies showed an exposure to low size, with the MSCI World Small Cap Index showing the strongest signal to low size. These findings suggest that a simple cap-weighted approach to small size investing has been effective in replicating the return premium.

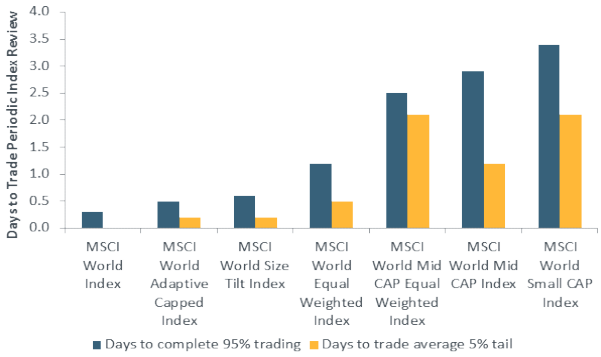
Exhibit 20: Signal Strength to Low Size



Average factor exposures from 1999 to 2015

For implementation purposes, however, we need to examine the investability of these indexes, which can be measured using our two core investability metrics, namely, liquidity and investment capacity. In Exhibit 21, we compared the liquidity profiles of the various size indexes based on an allocation of $10 billion. The MSCI World Adaptive Capped Index and the MSCI World Size Tilt Index were the most tradeable; it would have taken less than a day to complete 95% of the trade. The MSCI World Small Cap Index, while offering the strongest signal to low size, provided the lowest liquidity compared to its peers. On average, it would have taken about 3.5 days to complete 95% of the trading — still a reasonable length of time for a very sizeable allocation.

Exhibit 21: Liquidity of Size-Based Indexes

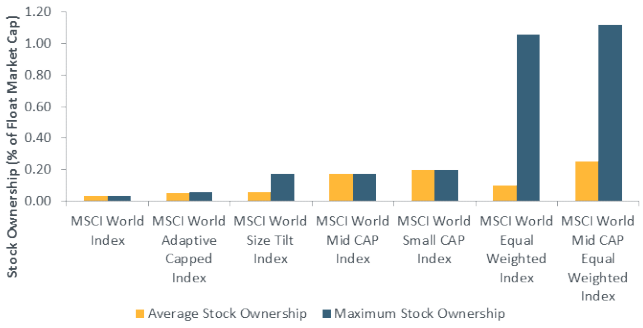


Average of last four index reviews ending December 31, 2015, and assuming a fund size of USD 10.0 bn as of the latest index review and a maximum daily trading limit of 20%

In Exhibit 22, we explored the investment capacity of these indexes. Investment capacity can be measured by calculating the amount of underlying stock owned in an index, given an

allocation of a certain size. Using a $10 billion allocation, all strategies showed relatively good investment capacity in terms of average stock ownership. Typically, most institutions would not want to own more than 5% of a stock in the underlying index. In terms of maximum stock ownership, in general, all strategies indicated very good capacity. The MSCI World Equal Weighted and MSCI World Mid Cap Equal Weighted indexes displayed good but not stellar capacity: Since each security would be allocated the same weight in these indexes, an investor with a $10 billion allocation could have owned up to about 1% of a stock.

Exhibit 22: Investment Capacity of Size-Based Indexes



Assuming a fund size of USD 10.0 bn as of the November 2015 index review

CONCLUSION

Contrary to skeptics' views, we find that the size premium exists globally. Size-based indexes, such as the size index family of the MSCI Global Investable Market Indexes are screened for investability and preserved the size premium. These indexes capitalized on both low size and mid-capitalization factors. In contrast, companies beyond the Investable Market Index universe revealed a stronger exposure to low size but exhibited significantly poor liquidity and investment capacity characteristics.

Size-based investing has been an integral part of the investment process for decades. In the last decade, transparent and rules-based factor indexes have become effective tools to gain exposure to the size premium; they can be used as the basis for passive replication in size portfolios. With the development of robust analytical tools, investors can gain a better understanding of the unintended consequences that small companies can have on portfolio return.

While constructing factor indexes, factor exposure has to be balanced with investability. Market-cap-based small-cap indexes, such as the MSCI World Small Cap Index, remain effective and investable ways of representing the size premium. With the evolution of sized-based indexing, investors now have other ways of accessing this premium via indexes such as equal-weighted, size-tilted and adaptive-capped. In addition, there exists a sweet spot in the all-cap spectrum; investors can use this insight to build "smarter" size portfolios. Investors considering size-based strategies must carefully evaluate their options to access the size factors. After all, no one size fits all.

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APPENDIX A: KEY METRICS OF DECILE 3-7

Exhibit A1: Key Metrics: Decile 3-7

	World	World IMI Deciles 3to7	World Small
Total Return* (%)	4.6	8.3	8.8
Total Risk* (%)	15.6	17.3	17.7
Return/Risk	0.29	0.48	0.50
Sharpe Ratio	0.15	0.35	0.37
Active Return* (%)	0.0	3.8	4.2
Tracking Error* (%)	0.0	6.3	6.9
Information Ratio	NaN	0.60	0.62
Historical Beta	1.00	1.04	1.05
Turnover** (%)	3.0	26.1	14.8
Price to Book***	2.2	1.7	1.7
Price to Earnings***	18.6	24.6	27.0
Div. Yield*** (%)	2.3	1.9	1.8

* Gross returns annualized in USD for the 12/31/1998 to 12/31/2015 period

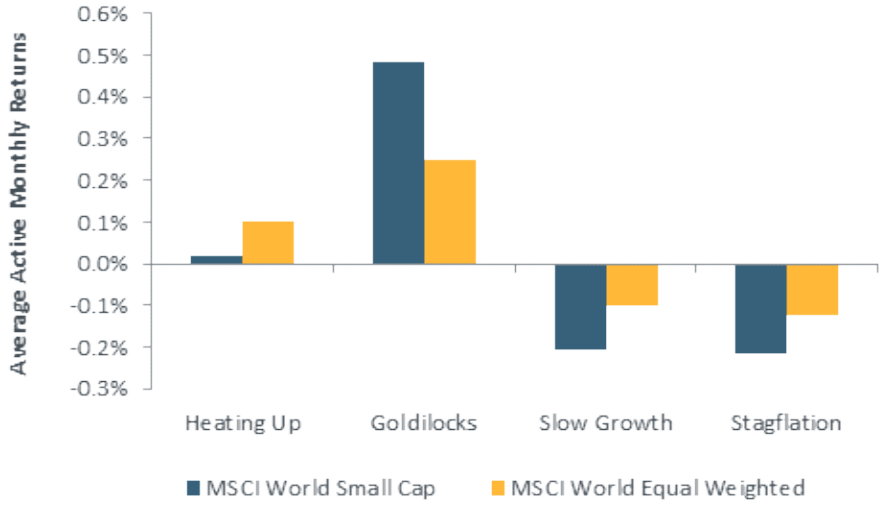
Deciles 3-7 of MSCI World IMI show very similar performance to the MSCI World Small Cap Index and can be a useful area for investors to further explore and create “smarter” size-based portfolios.

APPENDIX B: ECONOMIC REGIME BEHAVIOR

Previous MSCI research investigated the empirical behavior of equity factors in changing economic environments. In summary, small caps were shown to have pro-cyclical behavior (Gupta et al., 2014).

Exhibit B1 extends the bivariate regime analysis introduced in prior MSCI research[11] to compare the regime behavior of the MSCI World Small Cap and MSCI World Equal Weighted indexes. Low size underperformed during slow growth (weak growth, falling inflation) and stagflation (slow growth, rising inflation) periods. Low size did best in a Goldilocks regime (strong growth, falling inflation). Throughout this analysis, the MSCI World Small Cap Index had more pronounced reactions to macro regimes than the MSCI World Equal Weighted Index. This phenomenon could be attributed to the stronger exposure of the MSCI World Small Cap Index to the low size factor, which tends to be more sensitive to macro regime changes.

Exhibit B1: Regime Behavior of MSCI World Small Cap and World Equal Weighted Indexes

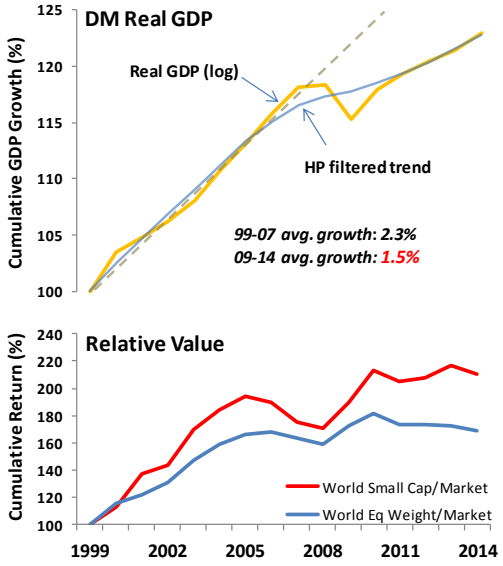


May 1994 to December 2015. CLI and CPI levels sourced from OECD.

[11] OECD CLI and CPI data are used jointly to characterize four regimes as increasing growth and increasing inflation (Heating Up), increasing growth and decreasing inflation (Benign Growth), decreasing growth and increasing inflation (Stagflation), and decreasing growth and decreasing inflation (Slow Growth). The active returns against the MSCI World Index are then compared to determine each strategy's sensitivity to a regime.

We also examined the impact of macroeconomic scenarios on relative index performance through the lens of the MSCI Macroeconomic Risk and MSCI Asset Pricing models.[12] Exhibit B2 shows how the performance (total return) of the MSCI World Small Cap/Equally Weighted indexes relative to the market relates to the macroeconomic environment, particularly to GDP trend growth. The relative performances are based on realized historical total return observations. Typically macro sensitive indexes, such as the MSCI Small Cap and Equal Weighted indexes, did better when GDP growth was above average and worse when GDP trend growth was low. This is why both the MSCI Small Cap and Equally Weighted indexes outperformed the market less after the crisis, which resulted in a lower growth environment. The MSCI World Small Cap index was even more sensitive to the macro shocks than the MSCI World Equally Weighted index, which is why it performed better at the beginning of the period, during times of a promising trend growth.

Exhibit B2: Economic Regime Behavior via Macro Model Lens[13]

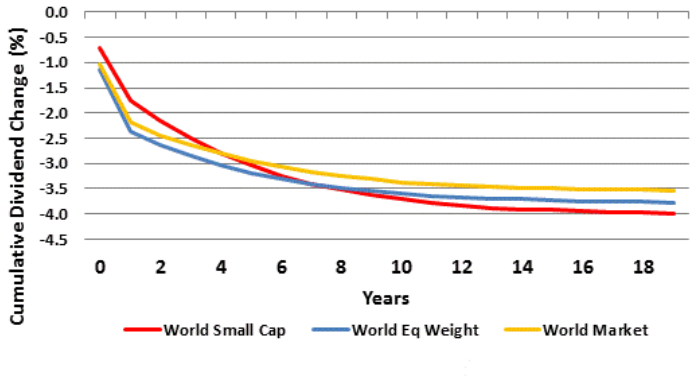


[12] For more details about the MSCI Asset Pricing Model, see "Pricing and Analyzing Macro Risk."(2013). MSCI Market Insight. For more information on the MSCI Macroeconomic Risk Model, see "The MSCI Macroeconomic Risk Model." (2016). MSCI Research Insight

[13] There is a gap between the pre-crisis trend with scattered line and the HP filtered current trend with solid blue

Exhibit B3 shows the response of the dividends to a one standard deviation negative GDP shock. Dividends of the MSCI World Small Cap Index fell the most while the MSCI World Index declined the least. This suggests that small caps carried the highest macro risk and as a result offered a premium for investors.

Exhibit B3: Response of Dividends to Negative GDP Shock



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