Size

Is There a Size Effect in the Stock Market?

By Wesley Gray, PhD February 14th, 2019

One of the oldest and most persuasive arguments in the stock market is that small stocks outperform large stocks.[1] Warren Buffett, speaking at the 2013 Berkshire Hathaway Annual Meeting, summarized the sentiment when discussing the disadvantages of managing a huge amount of capital:

There's no question size is an anchor to performance.

The implication is that managing a huge asset base prevents an investor from exploring the more intriguing opportunities available in smaller and more illiquid stocks.[2]

We agree with Buffett: having a fat wallet makes it tough to outperform. If investors are focused on long-term outperformance, small stocks are a good place to find outsized returns. Of course, you still need a solid underlying investment process – small stocks won't cure bad ideas. But coupling a reasonable process with smaller stocks can be a wonderful approach. For example, almost all popular investment factors, to include value and momentum, have historically worked much better in smaller stocks than they do in mega-cap stocks.

And while Warren Buffett's quote seems to suggest that the debate over the outsized potential of small caps is settled, it turns out there is substantial debate on the topic. Investors looking to make more informed portfolio decisions should be aware of these arguments before grasping small caps with both hands.

A Short History of the "Size Effect"

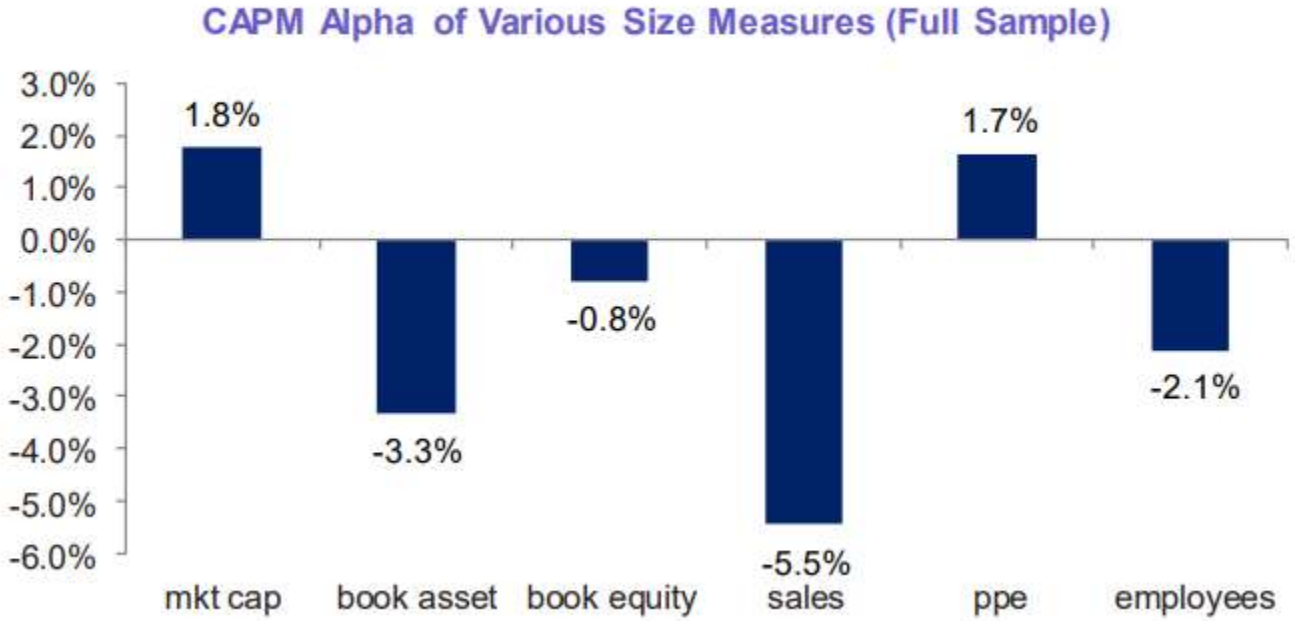
First, a little history on the research into the so-called "size effect." Rolf Banz pioneered the exploration of the size premium in his 1981 paper, "The Relationship Between Return and Market Value of Common Stocks." Prof. Banz found that, on average, small cap stock portfolios outperform large cap portfolios on a risk-adjusted basis. This research is often cited as the original "size effect" paper, but even in this original work the good professor highlights that there are 1) no theoretical foundations for the size effect and 2) his results could be proxying for a hidden factor. In other words, further research needed to be conducted.

Following the Banz paper, asset managers started developing products built on the premise that size matters. In today's market there are plenty of mutual funds, ETFs, and indexes where size is the core component of the process.

Is the Research on the Size Effect "Fake News?"

More recent research has dug even deeper, even questioning the data source from which many of the results are derived. In 2009 Professor Edward McQuarrie wrote a paper titled "The Myth of 1926: How Much Do We Know About Long-Term Returns on U.S. Stocks?" where he brought up some of the complications with the data-set for CRSP, specifically for small cap stocks. CRSP, which stands for the Center for Research in Security Prices, provides data for almost all the research done on equity prices in the United States. Prof. McQuarrie's concern is that the outperformance of small caps is concentrated in the very early years just after the Great Depression, exactly when there are the most issues in the CRSP database. (A more detailed look on these results are available here).

Perhaps the most interesting entrant into the discussion comes from the monster quantitative-focused asset manager, AQR. In their paper, "Fact, Fiction, and the Size Effect," the authors question if there ever was a size effect, after properly controlling for data issues, liquidity concerns, and proper adjustments for risk. In short, perhaps Banz's size effect never really existed! To many investors, who invest in products focused on small-cap stocks, this will surely come as a not-so-welcome surprise. (below is a chart from the paper that summarizes much of the analysis, and shows positive Alpha on "mkt cap", the usual measure of Size).



So, Does Size Matter in the Stock Market?

Perhaps not all is lost when it comes to investing in small-caps. Even the AQR researchers left some wiggle room for anyone who still wants to hang onto their beliefs regarding small stocks. For example, the authors find that size can enhance other strategies, such as value, momentum, and quality. This "wiggle room" has been confirmed in cutting edge academic research such as the paper, "Replicating Anomalies," by professors Kewei Hou, Chen Xue, and Lu Zhang, who replicate 447 anomalies in the stock market and identify that the biggest opportunities for market beating returns are *concentrated in smaller stocks*. Our own internal research confirms the same thing. Size matters – especially when mixed with strategies that look at cheap stocks (i.e., "value") or strong performing stocks (i.e., "momentum"). ...

For Factor Investors, It Pays to Go Small

Alex Bryan, CFA 04 Jul 2018

Tilting toward small-cap stocks alone isn't a great way to improve long-term performance. Small-cap stocks have historically offered a small edge over their larger counterparts, but that slight return advantage hasn't been much compensation for their higher risk and decade-long stretches of underperformance.

However, other factors, like value, momentum, and low volatility, have tended to work better among smaller stocks. Deliberately targeting small-cap stocks with these characteristics will likely be more fruitful than a broad-based approach to investing in a broader cross section of smaller firms.

The payoff to the value factor offers a stark illustration. Exhibit 1 shows the returns on 25 portfolios of U.S. stocks formed on the basis of stocks' size and book/price ratios (a measure of value, with larger values indicating relatively cheaper stocks). I've sourced this data from the French Data Library for the period from July 1963 through May 2018.

Each portfolio has roughly the same number of stocks and is market-cap-weighted, so the small-cap portfolios represent a smaller portion of the market than the large-cap portfolios. All portfolios are updated once a year at the end of June.

The column labeled "5–1" in Exhibit 1 shows the return spread between the portfolios of the cheapest and most-expensive stocks across five different size strata. So, for example, the cheapest fifth of U.S. large-cap stocks outpaced the most-expensive fifth by 1.62 percentage points annually, which isn't bad. But the return gap between deep-value and high-growth stocks increases dramatically as we move down the market-cap ladder.

Exhibit 1 - Returns on Portfolios Sorted by Size and Book/Price

	Low 1	2	3	4	High 5	5-1
Large	9.89	10.29	10.68	9.75	11.51	1.62
Mid	10.58	11.00	12.35	14.44	13.72	3.14
Small-Mid	8.64	13.22	12.95	14.91	16.12	7.48
Small	8.04	12.40	14.46	15.16	15.33	7.29
Micro	4.39	12.11	12.92	16.03	16.96	12.57

Source: French Data Library. Data from July 1963 through May 2018.

To understand this performance pattern, it is important to understand the explanations for the value effect more broadly. Value stocks are thought to outperform either because they are riskier than their more-expensive counterparts and offer higher expected returns to compensate investors for that risk, or because they are mispriced. The risk-based explanation is plausible. Value stocks tend to have less-attractive business prospects than more richly valued stocks. That said, growth stocks--especially small-growth stocks--come with significant risks of their own, most notably the risk of failing to live up to the lofty expectations embedded in their prices.

During the sample period, the large-value portfolio did in fact exhibit greater volatility and a larger maximum drawdown than its growth counterpart. But the opposite was true of the small-value portfolios, as shown in Exhibit 2. This suggests that these value portfolios were less risky than their growth counterparts and that mispricing is the more likely driver of their higher returns. It's reasonable to believe that small-cap stocks are more prone to mispricing than large-cap stocks because they don't attract as much investor attention or analyst coverage. Consequently, their prices may not reflect all publicly available information. However, we can't rule out the risk-based explanation for the value effect among small-cap stocks because risk can still be present without being realized. For example, even if a corporate borrower doesn't default on a loan, that outcome is still possible and investors must be compensated for that risk.

Exhibit 2 - Risk of Portfolios Sorted by Size and Book/Price

	Std Dev (%)		Max Drawdown (%)	
	Low 1	High 5	Low 1	High 5
Large	15.82	18.44	-52.08	-59.25
Mid	20.14	19.46	-66.39	-69.40
Small-Mid	22.57	19.32	-69.06	-49.00
Small	24.56	20.69	-74.84	-67.29
Micro	27.12	20.58	-83.74	-66.11

Source: French Data Library, analyst's calculations.
Data from July 1963 through May 2018.

Low Volatility

As is the case with value, the advantage of tilting toward low-volatility stocks has historically been the biggest among the smallest stocks, as Exhibit 3 illustrates. This table shows the returns on 25 portfolios of U.S. stocks sorted on size and volatility for the previous 60 days, updated monthly. The return spread between the least- and most-volatile fifth of U.S. large-cap stocks was 1.44 percentage points annualized from July 1963 through May 2018, but the corresponding figure among micro-cap stocks was 19.37 percentage points annually.

Exhibit 3 - Returns on Portfolios Sorted by Size and Volatility

	Low 1	2	3	4	High 5	5-1
Large	9.67	10.95	10.50	9.24	8.24	1.44
Mid	12.92	13.32	13.25	12.52	7.34	5.57
Small-Mid	13.75	14.21	15.37	13.72	6.32	7.43
Small	15.64	16.64	16.10	13.79	3.93	11.71
Micro	17.23	18.17	16.26	11.22	-2.14	19.37

Source: French Data Library. Data from July 1963 through May 2018.

The inverse relationship between stocks' size and the efficacy of the low-volatility effect likely stems from greater mispricing among smaller stocks. For instance, there may be greater lottery-seeking behavior among small-cap stocks, where investors overpay for volatile stocks that offer a small chance for a big payoff, because these stocks tend to offer greater upside potential than their larger counterparts. But that's not the whole story.

A regression analysis revealed that the low-volatility portfolios tended to favor cheaper and more-profitable stocks than their more-volatile counterparts. So, one of the reasons the low-volatility effect works the best among the smallest stocks is because it partially captures the value effect. Additionally, the low-volatility portfolios had greater exposure to the momentum factor (which has historically been associated with higher returns), and this gap was the widest among micro-cap stocks and the narrowest among large-cap stocks. This suggests that momentum contributed to the greater efficacy of the low-volatility strategy among the smallest stocks.

Momentum

Momentum has also tended to offer the best returns among the smallest stocks, at least on paper, as Exhibit 4 shows. In practice, the transaction costs of this high-turnover strategy would eat a big chunk of these hypothetical returns, so a micro-cap momentum strategy isn't advisable. But this return pattern provides further

support for the idea that there is greater mispricing among the smallest stocks in the market than there is among large caps.

Exhibit 4 - Returns on Portfolios Sorted by Size and Momentum

	Low 1	2	3	4	High 5	5-1
Large	4.21	9.38	9.00	10.78	13.24	9.03
Mid	4.10	10.54	11.85	13.62	16.21	12.10
Small-Mid	4.76	10.86	12.43	13.20	17.72	12.95
Small	3.17	11.57	13.93	16.04	17.88	14.71
Micro	1.71	11.42	15.12	16.97	19.79	18.08

Source: French Data Library. Data from July 1963 through May 2018.

Momentum likely arises because investors are slow to react to new information, causing prices to adjust more slowly than they should. Because smaller stocks don't attract as much attention as larger ones, it probably takes longer for new information to be reflected in their prices, which could explain why the returns to momentum are higher among smaller names. Once a trend is established, investors may pile into the trade, pushing prices away from fair value, leading to the long-term reversals associated with the value effect. So, this bigger momentum effect among small stocks is also consistent with a bigger value effect.

Profitability

Unlike the other factors, profitability (investing in the most-profitable firms) worked almost as well among large-cap stocks as it did among the smallest stocks, as illustrated in Exhibit 5. It isn't obvious why this factor bucked the small-cap amplification pattern. However, it may have something to do with the fact that the largest stocks in the market tend to be the most profitable.

Exhibit 5 - Returns on Portfolios Sorted by Size and Profitability

	Low 1	2	3	4	High 5	5-1
Large	7.59	8.52	9.86	10.21	11.12	3.53
Mid	9.81	12.13	11.83	12.37	13.70	3.89
Small-Mid	9.24	13.11	12.80	12.70	14.55	5.32
Small	9.47	12.93	13.82	12.83	15.03	5.56
Micro	8.72	14.95	13.95	15.11	13.00	4.28

Source: French Data Library. Data from July 1963 through May 2018.

Highly profitable stocks tend to be less volatile and hold up better during market downturns than their less-profitable counterparts. So, if anything, it would be reasonable to expect these stocks to offer lower returns for their relative safety. Of course, there is always a risk that they could underperform, as they often do during strong market rallies.

It is likely that mispricing across the market-cap spectrum contributed to this effect. For example, highly profitable stocks could become undervalued if investors do not fully appreciate the long-term sustainability of

their earnings power. Or they may simply prefer riskier stocks that offer greater return potential, similar to the low-volatility effect. Yet, to the extent that the profitability and low-volatility effect arise from a common bias, it is a bit of a puzzle why the former wasn't also much bigger among the smallest stocks.

The U.S. results were consistent with the factor return patterns among international stocks. I ran a similar analysis using the global ex-U.S. portfolios formed on profitability, value, and momentum (low-volatility portfolios weren't available) from November 1990 through May 2018. Value and momentum worked much better among the smallest stocks than among the largest, while profitability only worked slightly better among the smallest stocks.

Profiting From Small-Cap Factor Amplification

Although each of the factors examined here, apart from profitability, performed much better among small-cap stocks than among large ones, the vast majority of assets invested in factor strategies are in large-cap funds. It's true that large-cap strategies have greater capacity than their small-cap brethren and are less risky, generally making them better core holdings. And yes, transaction costs will likely create a bigger drag on a momentum strategy applied to small caps than to large caps. But the performance advantage from tilting toward factors like value and low volatility is nonetheless likely to be larger among small-cap stocks. ...

Bronze-rated Invesco S&P SmallCap Low Volatility ETF (XSLV) (0.25% expense ratio) offers clean exposure to stocks with low volatility. Each quarter, it ranks the stocks in the S&P SmallCap 600 Index by their volatility during the past 12 months and targets the least-volatile 120. It then weights these holdings by the inverse of their volatility, so that the least volatile stocks get the largest weightings in the portfolio. The fund has been successful at reducing volatility and downside risk, but it does take big sector bets from time to time, which may not always pay off.

For those who do want to profit from momentum in the small-cap arena, it would probably be best to get that exposure through a multifactor fund, like iShares Edge MSCI Multifactor USA Small-Cap ETF (SMLF) (0.30% expense ratio). This is because 1) it will have lower turnover than a stand-alone momentum fund, and 2) it should better diversify risk. This fund targets small-cap stocks with strong value, momentum, quality, and small size characteristics under constraints that mitigate sector bets and turnover. Its holistic approach and demanding selection criteria should give it potent exposure to the factors it targets.

Three more recent research papers from Verdad concerning Size. The first from Dan Rasmussen on 2/19/19 demonstrates that the Value Factor, as defined by Fama and French, is almost exclusively found among Small-Cap stocks. The 2nd and 3rd from Nick Schmitz on 11/5/18 and 11/12/18 respectively show that Size also matters in Japan and Europe. It should be noted that Verdad currently runs 2 funds, 1 of which is focused on Japan and is soft closed, and is in the process of launching a Europe Fund.

Why do most active managers fail?

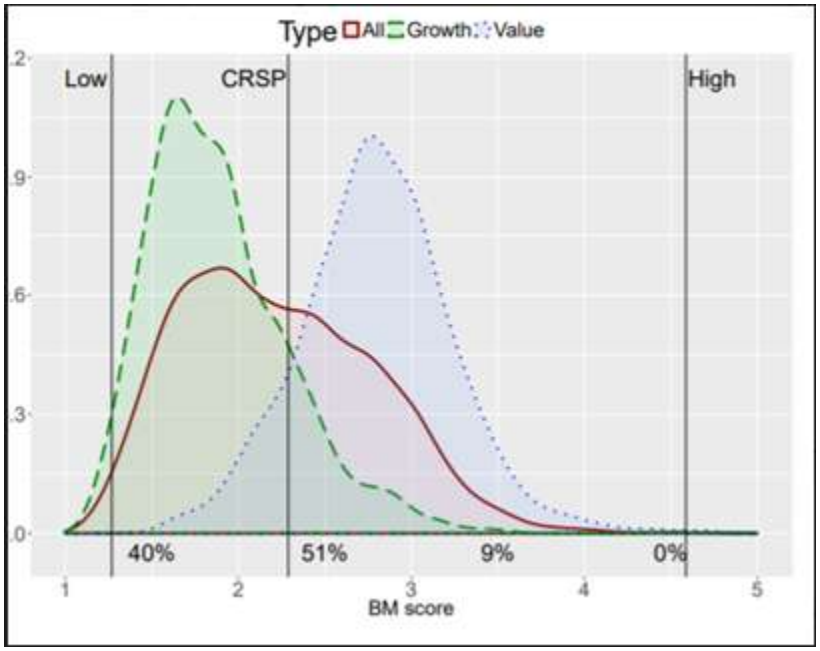
Why do most active managers fail to beat the market? It’s a question we have returned to over and over again in our research.

We have hypothesized that one problem with active managers is that they base their investment strategies on bad theory. Most active managers use DCF models, spend untold hours forecasting unpredictable earnings growth rates, look for glamorous "competitively advantaged" businesses, try to back great CEOs, and generally follow a variety of empirically invalidated approaches in their efforts to beat the index.

But a new study suggests that the problem isn't just that active managers slavishly follow bad theories but rather that they persistently refuse to apply good theory. Value investing is one of the simplest and best investing ideas, pioneered by Benjamin Graham, confirmed empirically by Fama and French, and replicated dozens of times in study after study. But after performing a comprehensive analysis of the portfolios of active mutual funds, ETFs, and hedge funds, Martin Lettau of UC Berkeley found that there were virtually no funds that actually exclusively held the cheapest stocks. In fact, most "value" funds hold a higher proportion of their portfolios in expensive growth stocks than cheap value stocks.

Active mutual fund portfolios skew heavily toward expensive growth stocks and away from the value stocks that theory and evidence suggest provide the most attractive forward returns. Lettau charted the value-weighted average book-to-market ratio for each mutual fund. The below histogram shows the distribution of funds. The x-axis is divided into quintiles based on the book-to-market ratios of all the stocks in the stock market, with the most expensive quintile (low book-to-market) on the left and the cheapest quintile (high book-to-market) on the right.

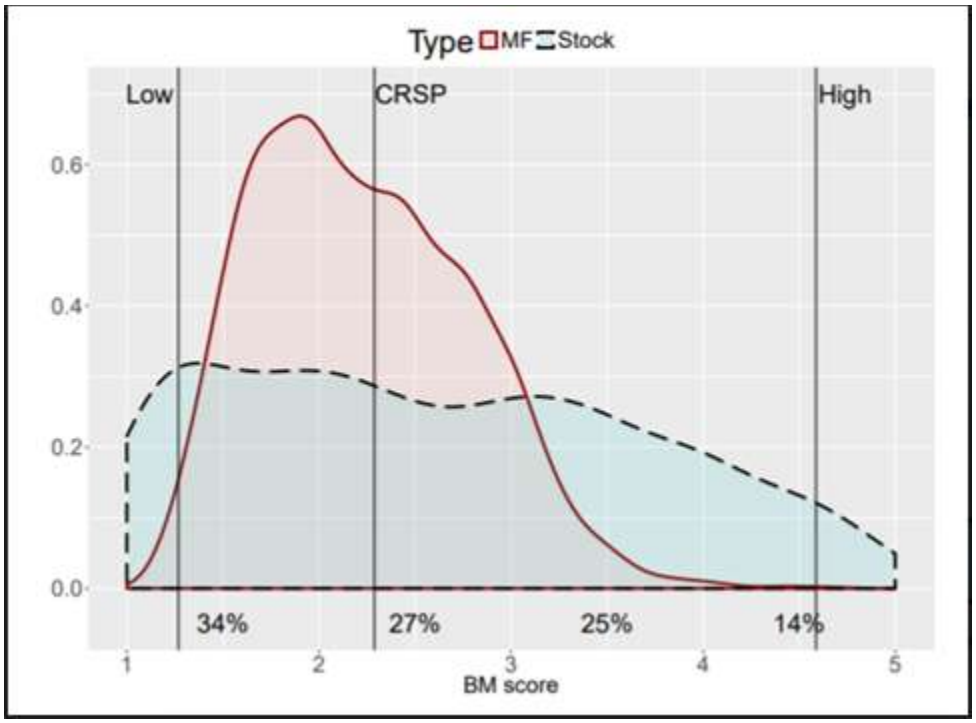
Figure 1: Distribution of Mutual Funds by Value-Weighted Avg. Book-to-Market Ratio 1980–2016



Source: Lettau et al., "Characteristics of Mutual Fund Portfolios: Where Are the Value Funds?"

There are almost no value funds that score in the fourth or fifth quintile of value. Comparing the distribution of mutual funds versus the distribution of stocks, we see a massive difference, with active managers almost completely avoiding the cheapest stocks (high book-to-market) while instead owning primarily stocks that are more expensive (low book-to-market).

Figure 2: Distribution of Mutual Fund Holdings vs. S&P 500 Constituents by Book-to-Market Ratio 1980–2016



Source: Lettau et al., "Characteristics of Mutual Fund Portfolios: Where Are the Value Funds?"

The authors find similar results for hedge funds and ETFs. They conclude that it is virtually impossible to find mutual funds that provide true exposure to the value factor as defined in academic research. We believe value is one of the best proven strategies for beating the market. Yet the portfolios of active managers are tilted toward expensive growth stocks.

The authors are puzzled by these findings. "How can the stylized facts presented in this paper be reconciled with the evidence that capital flows react strongly to past performance? Since returns of high-BM [cheap] stocks are on average higher than returns of low-BM [expensive] stocks, capital should flow from low-BM funds into high-BM mutual funds over the sample, and the number of high-BM funds should increase relative to the number of low-BM funds," they write. "Yet, there is no evidence to support this conjecture."

What explains this puzzle? Why are active managers almost completely avoiding the cheapest two quintiles of the market and skewing their portfolios so heavily toward expensive growth stocks? The bad theories we cited are certainly a factor: expensive glamor stocks tend to have high forecast growth rates, star CEOs, wide moats, and sexy stories.

But perhaps the most important and underappreciated reason for this puzzling finding is structural: the business incentives of active management itself.

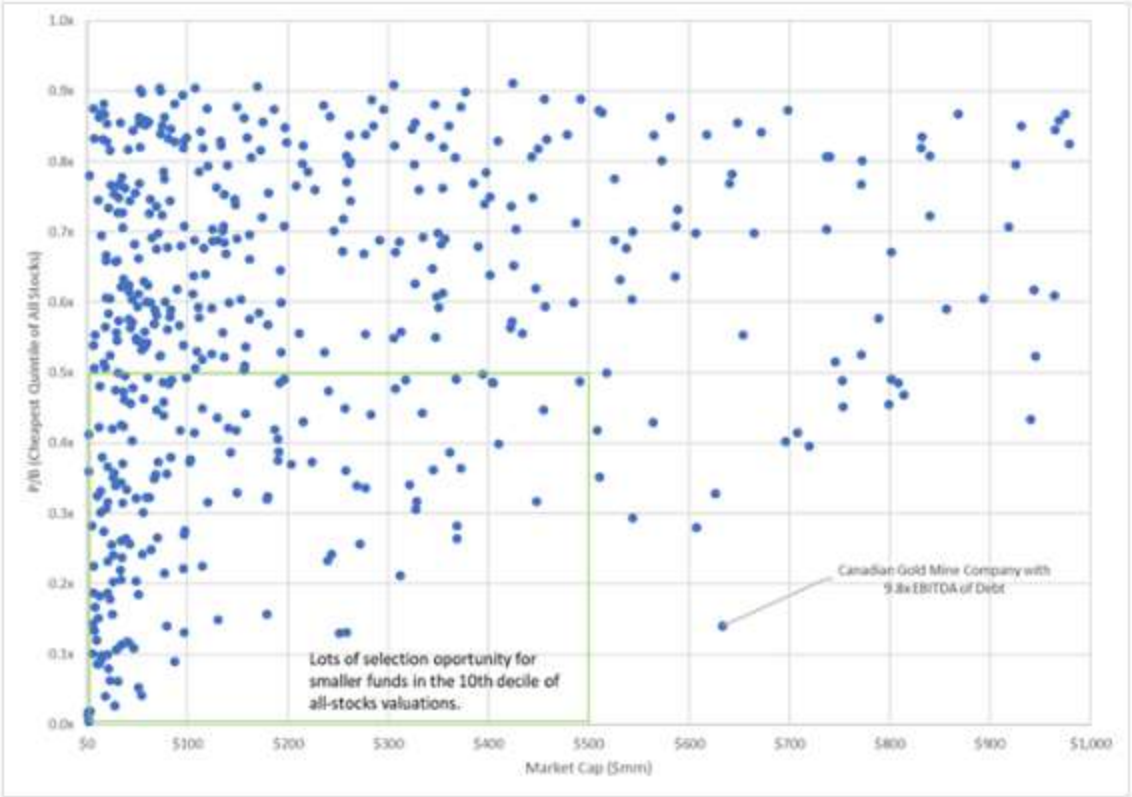
Below we show a table dividing the US stock market into deciles based on price-to-book ratio. There is a strong linear relationship between valuation, market capitalization, and traded volume.The cheapest two deciles of the stock market have median market capitalizations of less than $400M and median daily trading volume less than $1.5M (in contrast, the most expensive two deciles have median market capitalization of over $1.9B and average daily volume of over $15M).

Figure 3: Descriptive Characteristics of the US Stock Market Divided by Valuation Decile

Universe Deciles by Value		Descriptive Characteristics		
Percentile	P/B	Median MCAP in Decile ($mm)	Median Volume in Decile ($mm)	Implied Fund Capacity
10%	0.6x	$103	$0.3	$40
20%	0.9x	$353	$1.4	$175
30%	1.2x	$547	$2.2	$250
40%	1.5x	$645	$2.7	$325
50%	1.9x	$1,070	$5.4	$650
60%	2.5x	$1,395	$8.6	$1,000
70%	3.3x	$1,450	$9.0	$1,100
80%	4.6x	$1,843	$12.8	$1,500
90%	7.8x	$1,981	$15.3	$1,800
100%	291.6x	$2,672	$24.0	$2,900

Note: Implied fund capacity assumes a diversified 40-stock portfolio at 3x the daily volume of the median stock. Source: Capital IQ, Verdad.

Figure 4: Scatter Plot of US Equities by Valuation and Market Cap



Source: Verdad, Capital IQ.

To put it simply, the cheapest stocks are disproportionately small in terms of size and volume. This means that an active manager looking to choose, say, the best 40 of these stocks would be unable to manage more than $200M or so. Even a more passive, quasi-indexed, approach owning the 200 cheapest stocks could only handle about $1B. And, unfortunately, even the index providers have chosen to go for scale, with Vanguard's US small value fund managing about $26B and Dimensional's US small value fund managing $14B. This leaves investors with few options for accessing the academic value premium - particularly with any active overlay – and has created disappointment for investors who buy value funds expecting to get the academic value premium.

To further illustrate how constrained the universe of true value stocks is, consider the above scatter plot, which charts US companies by price-to-book ratio on the y axis and market cap on the x axis. The only company above $400M of market cap in the bottom two deciles of valuation is a Canadian gold miner with 9.8x debt/EBITDA and a -90% LTM stock price return: not exactly something anyone should be putting a large percentage of their fund in.

The cheapest two deciles of the market are almost entirely composed of micro-cap stocks that are hard for any fund with >$200M in assets under management to trade. A manager attempting to build a portfolio composed of the bottom two deciles of value would therefore have to restrict assets under management to <$200M, a business decision that very few fund management companies are willing to make given that it sets a limit on the revenue and profit the manager can earn.

In fact, the average small value fund tracked by Morningstar has $1.3B of assets under management. It is close to impossible to deploy that amount of capital exclusively in the cheapest two deciles of the stock market. These managers are instead stuck with a universe of potential opportunities that, by virtue of market capitalization and tradable volume, have almost no true value stocks as measured by purely quantitative methods. ...

Size Matters: How Market Structure Favors Small Funds

Part I: Japan

Since Eugene Fama revolutionized the field of quantitative finance by introducing the size and value factors to securities pricing models, few debates have occupied the minds of finance academics and practitioners as much as the existence of a size premium.

Academics at fund manager AQR sparked the most recent round in this age-old debate by releasing a paper arguing that there is "no evidence of a pure size effect" ....

But do smaller companies provide excess returns (or excess risk-adjusted returns) over the long haul? Broadly speaking, does size matter?

We believe that the answer is "it depends" for individual stocks but "yes" for strategies based on selecting individual stocks. The simple reason for this is that there are far more small stocks than large stocks and also far greater dispersion on key variables (i.e., if you're looking for cheap stocks, there will be a far higher absolute number of cheap small stocks than cheap large stocks, and the 10th percentile of the cheap small stocks will be far cheaper than the 10th percentile of the cheap large stocks).

Given that most investors' primary concern is how to identify strategies that have a high probability of significantly outperforming the broader market, we would argue that the importance of size cannot be understated. But this is not a story most fund managers are willing to tell, because this story suggests that the ability to generate alpha is negatively correlated with the assets under management in a strategy.

... we'll start with an examination of market structure in the two largest investible stock universes outside of the US with rigorous financial reporting standards (Part 1: Japan; Part 2: Europe) ....

Findings from Japan:

Knowledge of terrain is crucial for any strategic decision making. In public equity strategies, this terrain can be thought of as the total universe of investible stocks along with their most strategically relevant attributes for market participants. Below we have charted the bird's eye view of all listed public stocks in Japan above $50mm in market capitalization sorted by size.

What's striking about this market environment is how many small companies there are relative to large companies. If one were running an investment strategy in this environment with a rule that constrained the strategy to only stocks above $2bn in market cap, one would be passing over 85% of the potential targets in the environment! If the rule were "only stocks over $500mm", one would still be passing over 2/3 of investable opportunities.

Figure 1: Distribution of Japanese Public Equities by Market Capitalization*

Market Cap ($mm)	% of Stocks Below
Toyota ($180,000)	100%
$10,000	96%
$5,000	92%
$2,000	85%
$1,000	76%
$500	65%
$250	50%

While theoretically supportive of the hypothesis that size matters, the disproportionate selection choice in the small-cap world is not by itself proof that size = excess returns. We would need some evidence that the broader selection characteristic afforded by access to small caps is related to factors that reliably predict excess returns.

One of the most robust and reliable factors for predicting excess returns over the long haul is value. Below are the returns by decile of all stocks in the same Japanese market sorted each year by their valuation multiples from most expensive down to least expensive. On the left we have included the returns data for the entire millennium as well as the returns over the last five years, during a strong growth rally. On the right we have included the average multiple over the entire period to give you some idea of how cheap/expensive these stocks were in absolute terms.

Figure 2: Returns by Decile of Valuation Multiple (left) and Multiple Spreads (right)*

		Returns by Valuation Percentile						Spreads by Valuation Metrics		
		2000 - 2018			Last 5 Years (2013 - 2018)			2000 - 2018		
	Percentile	P/B	TEV/EBITDA	EBITDA Yield	P/B	TEV/EBITDA	EBITDA Yield	P/B	TEV/EBITDA	EBITDA Yield
Expensive	0% to 10%	4%	4%	5%	18%	10%	13%	12.7x	30.7x	5%
	10% to 20%	6%	5%	3%	20%	16%	18%	3.2x	15.0x	8%
	20% to 30%	7%	7%	7%	19%	18%	22%	2.1x	11.2x	11%
	30% to 40%	9%	9%	8%	21%	23%	18%	1.7x	9.3x	13%
	40% to 50%	9%	9%	9%	19%	19%	20%	1.4x	7.9x	16%
	50% to 60%	9%	9%	10%	19%	20%	21%	1.2x	6.8x	18%
	60% to 70%	11%	11%	11%	19%	21%	21%	1.0x	5.8x	22%
	70% to 80%	12%	12%	12%	20%	22%	22%	0.8x	4.8x	26%
	80% to 90%	14%	15%	14%	22%	24%	23%	0.7x	3.5x	34%
Cheap	90% to 100%	16%	15%	16%	24%	24%	24%	0.6x	1.2x	88%

You will note that regardless of size, the cheapest stocks in the market have dramatically outperformed the most expensive. Even during the last five year's growth rally, the cheapest stocks still seem to provide some excess returns. The data suggests that if you built portfolios at less than 1x book value, 6x EBITDA, or with a 20%+ EBITDA yield, you would have done quite well.

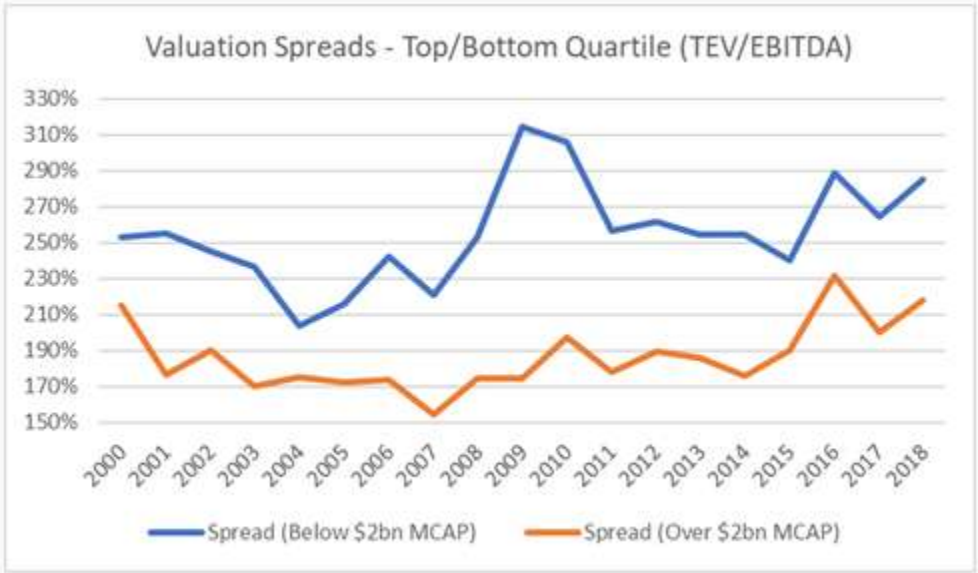
The next logical question is: are the cheapest stocks easier to access in the small-cap universe? Yes. Below are the valuation spreads over time within the ~85% of listed companies that are under $2bn of market capitalization and the ~15% of listed companies that are over $2bn of market capitalization.

Figure 3: Valuation Multiple Spreads for Small Caps (left) and Large Caps (right)*

	Small Caps - Percentile of Value (TEV/EBITDA)					Large Caps - Percentile of Value (TEV/EBITDA)				
Year	10%	25%	50%	75%	90%	10%	25%	50%	75%	90%
2000	NM	17.6x	10.1x	6.9x	4.2x	43.9x	20.3x	13.2x	9.4x	7.2x
2001	34.7x	14.8x	9.1x	5.8x	3.9x	22.4x	14.4x	10.5x	8.1x	6.7x
2002	66.1x	15.4x	9.6x	6.3x	3.7x	21.5x	14.7x	10.4x	7.8x	6.2x
2003	38.6x	12.6x	8.0x	5.3x	3.5x	19.1x	11.0x	8.2x	6.5x	5.1x
2004	25.1x	13.1x	9.1x	6.4x	4.4x	19.1x	12.4x	9.0x	7.1x	5.8x
2005	33.9x	13.3x	8.5x	6.2x	4.6x	15.4x	11.2x	8.1x	6.5x	5.5x
2006	NM	16.5x	9.5x	6.8x	4.9x	18.7x	13.9x	10.1x	8.0x	6.1x
2007	29.0x	13.2x	8.5x	6.0x	4.2x	18.0x	12.6x	9.8x	8.1x	6.6x
2008	19.3x	10.1x	6.1x	4.0x	2.7x	14.5x	10.1x	7.6x	5.8x	4.6x
2009	35.2x	12.8x	6.9x	4.1x	2.5x	18.8x	11.4x	8.3x	6.6x	5.1x
2010	28.2x	11.7x	6.3x	3.8x	2.2x	17.7x	11.4x	8.0x	5.8x	4.5x
2011	15.8x	8.3x	5.1x	3.2x	1.8x	13.7x	9.0x	6.6x	5.1x	4.0x
2012	14.9x	8.0x	5.0x	3.1x	1.8x	16.1x	9.7x	6.5x	5.1x	3.9x
2013	22.5x	10.3x	6.4x	4.1x	2.5x	20.9x	12.6x	9.1x	6.8x	5.2x
2014	24.5x	10.8x	6.6x	4.2x	2.7x	20.9x	11.8x	8.9x	6.7x	5.2x
2015	32.6x	12.6x	7.8x	5.2x	3.3x	25.1x	14.6x	10.2x	7.7x	6.1x
2016	26.4x	10.7x	6.2x	3.7x	2.1x	23.6x	13.6x	8.7x	5.9x	4.3x
2017	34.6x	13.6x	8.0x	5.2x	3.1x	23.2x	14.8x	10.1x	7.4x	5.8x
2018	35.7x	14.0x	7.8x	4.9x	3.1x	22.6x	14.7x	9.7x	6.8x	5.3x

Smaller companies were cheaper in almost every year we measured. However, what's even more interesting from a portfolio construction standpoint is that if one wanted to build a portfolio below 5x EBITDA, one would have had a hard time finding very many companies at all in the large-cap space (the 90th percentile among large caps was 5.3x EBITDA last summer). In the much more numerous small-cap universe, more than 1 in 4 companies meet that criterion. The valuation spreads between the most expensive and least expensive companies in the small-cap space are much wider.

Figure 4: Valuation Spreads over Time (June of Each Year)*



Perhaps there is some common characteristic of larger companies that makes them more attractive than smaller companies and justifies these valuation spreads. ... However, a far simpler explanation is looking more and more plausible: the relative valuations are unjustified by fundamentals and fundamental expectations.

However, none of this theory, as simple as it sounds, matters if we can't show that a strategy to exploit the unique quantitative characteristics of small-cap companies would have worked. Below are the results of three simple strategies backtested since 2000 at different portfolio concentrations. This is not a backtest of Verdad's strategy. We simply sorted all Japanese stocks by their cheapness (EBITDA multiple and price-to-book value) for the last ~20 years in each strategy. The only difference between the three strategies is that we increased the minimum average daily trading volume (a proxy for size) of the companies that were included in the universe of investible stocks. Think all-caps ($100k min volume), medium and large-caps (>$500k), and large-cap only (>$1mm) strategies.

Figure 5: Deep Value Strategy Results by Concentration and Size Constraint (2000–2018)**

Average Annualized Return 2000 - 2018			
Portfolio Concentration	$100k	$500k	$1mm
20	18.0%	15.1%	14.0%
30	16.9%	14.7%	13.9%
40	17.2%	14.7%	12.9%
50	17.1%	14.4%	13.2%
75	16.7%	13.7%	12.3%
100	16.4%	13.0%	12.4%
150	15.0%	13.3%	11.3%
200	14.6%	12.4%	10.9%
MSCI Japan Small Value (500)	8.6%	8.6%	8.6%

Sharpe Ratio		
$100k	$500k	$1mm
0.91	0.75	0.71
0.88	0.74	0.70
0.91	0.74	0.67
0.93	0.75	0.69
0.92	0.72	0.66
0.91	0.70	0.67
0.84	0.72	0.62
0.83	0.68	0.60
0.53	0.53	0.53

~Capacity ($mm)		
$100k	$500k	$1mm
$ 13	$ 94	$ 115
$ 20	$ 132	$ 187
$ 27	$ 175	$ 274
$ 37	$ 220	$ 349
$ 62	$ 314	$ 546
$ 85	$ 436	$ 780
$ 135	$ 654	$ 1,233
$ 187	$ 872	$ 1,662

As you can see, there is a direct trade-off between both absolute and risk-adjusted returns (left) and strategy capacity, or how much money you could reasonably put to work while achieving these results (right). This suggest that if there are excess returns anywhere in the market, those returns are in precisely the stocks that are on the verge of being inaccessible to most fund managers (and ETF products) seeking to run higher amounts of assets under management. Whether one waters down a powerful ranking system by including too many stocks, or stays concentrated with just a few higher-volume names, there is no way out of the performance degradation

to the strategies. Markets appear to be robustly efficient on nearly every metric except the prohibitively high-cost business decision of most investment funds to reduce capacity.

To us, this structural hypothesis is a far more intuitively and empirically sound explanation of the nature of excess returns in smaller companies. What's more, this hypothesis offers a pretty good explanation of what the real costs of such a strategy are for relevant market participants, rather than the "free-lunch" premium explanation of equity returns we find in the 85% of published quant literature that doesn't replicate when you exclude small caps. ...

Notes:

** Source: Capital IQ. All publicly listed Japanese companies on the Tokyo Stock Exchange and JASDAQ above $50mm in market cap each June. Excludes Banks, REITS, and Capital Markets Securities.*

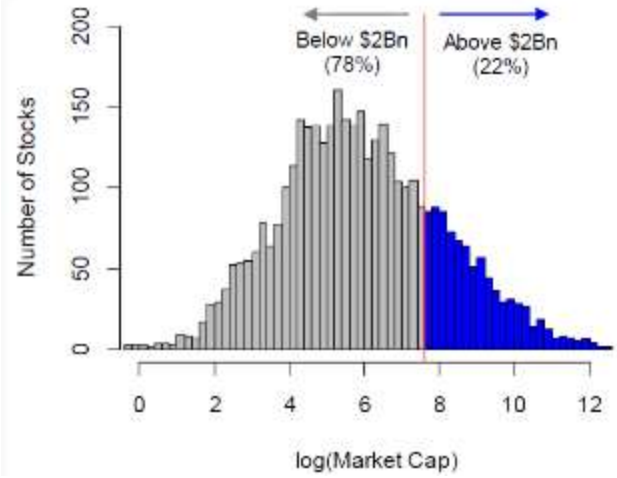
*** Source: Capital IQ. Portfolios rebalanced each June from 2000 to 2017 based on trailing TEV/EBITDA and price-to-book weights only for all publicly listed Japanese stocks above $50mm in market cap.*

"~Capacity" estimated as 5x the average daily volume of the bottom quartile of volume of the equal-weighted portfolio. Total returns indicated are in Yen. The MSCI Japan Small Value Index represents ~500 stocks on the Tokyo Stock Exchange.

Size Matters, Part II: Evidence from Europe

... Below is the distribution of public companies by market capitalization in Europe. A fund manager who is constrained to investing in large cap stocks would miss 78% of the opportunity set.

Figure 1: Market Cap Distribution in Europe (June 2018)



Market Cap ($mm)	% of Stocks Below
$293,000 (Royal Dutch Shell)	100%
$10,000	93%
$5,000	88%
$2,000	78%
$1,000	69%
$500	57%
$250	46%

Sources: S&P Capital IQ and Verdad analysis.

The opportunity set in small-caps is also more attractive than in large caps because there is much wider dispersion in small-caps relative to large-caps. We know, for example, that valuation metrics like Price/Book, EV/EBITDA (1 of the 3 metrics HCM uses) and EBITDA yield (EBITDA divided by market cap) reliably predict returns. Below, we show annual returns for all European stocks sorted by valuation metric.

Figure 2: Returns by Valuation Decile in Europe (July 1997–June 2018)

		Average Annual Returns			Valuations		
	Decile	Price/Book	EV/EBITDA	EBITDA Yield	Price/Book	EV/EBITDA	EBITDA Yield
Cheap	10	11.8%	14.7%	13.1%	0.6x	1.4x	62.2%
	9	10.0%	12.6%	11.6%	0.9x	5.4x	26.9%
	8	8.8%	12.4%	10.9%	1.2x	6.7x	20.0%
	7	8.4%	10.3%	9.8%	1.5x	7.9x	16.1%
	6	7.7%	8.6%	10.1%	1.8x	9.2x	13.4%
	5	7.8%	8.5%	9.9%	2.2x	10.6x	11.3%
	4	7.3%	8.7%	8.3%	2.7x	12.3x	9.4%
	3	8.4%	6.1%	7.1%	3.5x	16.8x	6.9%
	2	7.7%	4.3%	5.4%	5.1x	32.1x	3.6%
Expensive	1	5.4%	-2.9%	-2.7%	17.9x	94.6x	1.1%
Return Spread (10 - 1)		6.4%	17.5%	15.8%			
T-Statistic		5.65	15.52	13.97			

Sources: S&P Capital IQ and Verdad analysis.

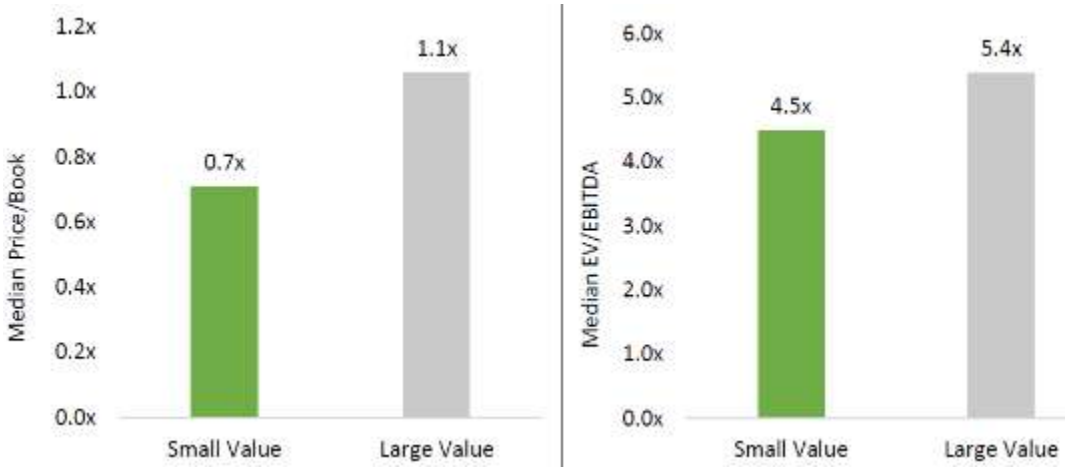
The cheapest decile of European stocks has outperformed the most expensive decile by anywhere between 6.4% and 17.5% per year since 1997. However, most of this value premium is attributable to small companies. Figure 3 shows the difference between the average annual returns of the cheapest decile of stocks and the most expensive decile of stocks, split by large-caps and small-caps. As you can see, the value premium is much higher and more reliable among small-caps.

Figure 3: Return Spreads by Size (Left) and their Statistical Reliability (Right), July 1997–June 2018

Sources: S&P Capital IQ and Verdad analysis.

And why is the value premium more robust among small stocks? Because the cheapest stocks within the small-cap segment tend to trade at a discount to the cheapest stocks within the large-cap segment. Figure 4 illustrates this point by comparing the cheapest 20% of small-cap stocks (small value) against the cheapest 20% of large-cap stocks (large value) between 1997 and 2018.

Figure 4: Small Value Stocks are Cheaper than Large Value Stocks (July 1997–June 2018)



Sources: S&P Capital IQ and Verdad analysis. Small value is defined as the cheapest 20% of small-cap stocks. Large value is defined as the cheapest 20% of large-cap stocks.

So what does this mean for the returns of a fund relative to its size? To achieve higher returns, a fund manager has to be willing to stay small in order to concentrate on the cheapest small-cap stocks with lower trading volume. Figure 5 illustrates this point through backtests of value strategies at various levels of portfolio concentration and liquidity. Although these backtests do not reflect Verdad's strategy of targeting leveraged small value equities, the conclusions regarding fund size and returns are similar in our strategy. Value strategies that were more concentrated and focused on smaller, less liquid stocks had higher returns and Sharpe Ratios between July 1997 and June 2018.

Figure 5: Value Strategies in Europe (July 1997–June 2018)

Annualized Returns

	Minimum Trading Volume		
Portfolio Concentration	$100K	$500K	$1M
20	16.3%	13.3%	11.8%
30	14.8%	13.6%	12.2%
40	14.7%	13.7%	11.3%
50	14.9%	13.1%	11.1%
75	14.0%	12.4%	10.5%
100	13.4%	11.7%	10.4%
150	12.6%	11.6%	10.5%
200	12.3%	11.4%	10.3%
MSCI Europe Small Value	9.9%	9.9%	9.9%

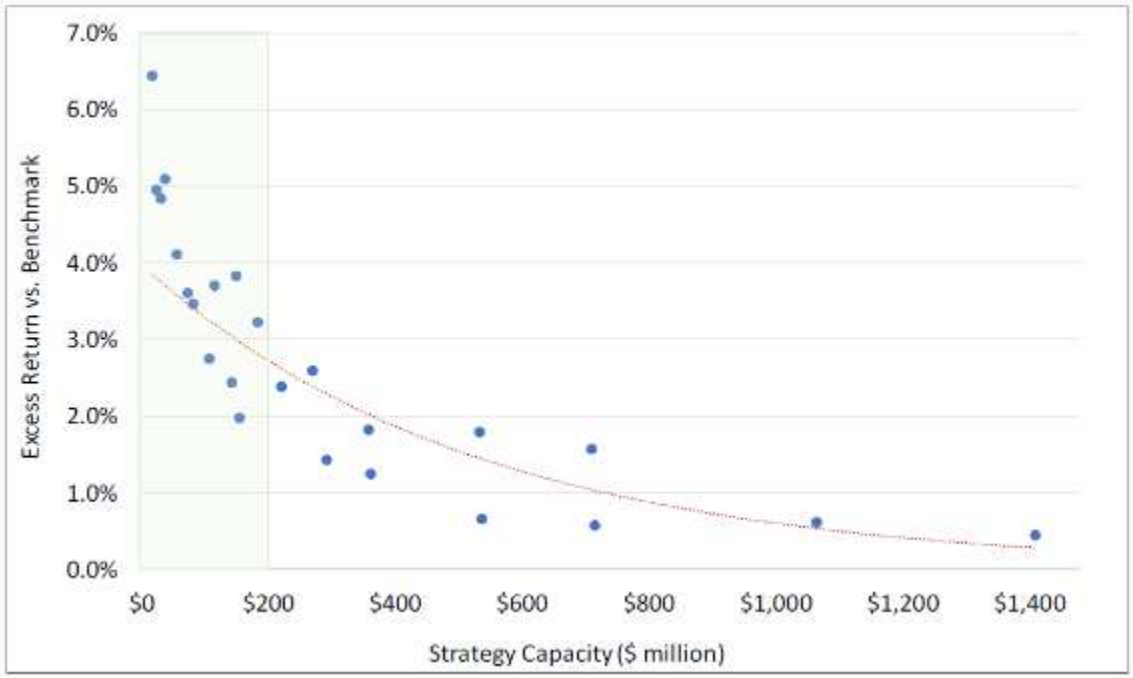
Sharpe Ratio

	Minimum Trading Volume		
Portfolio Concentration	$100K	$500K	$1M
20	0.56	0.43	0.38
30	0.52	0.47	0.41
40	0.54	0.49	0.38
50	0.56	0.48	0.39
75	0.55	0.47	0.39
100	0.55	0.46	0.40
150	0.53	0.48	0.42
200	0.53	0.48	0.43
MSCI Europe Small Value	0.47	0.47	0.47

Sources: S&P Capital IQ, MSCI, and Verdad analysis.

We can also estimate the capacity of each value strategy, based on the minimum trading volume of its holdings. Strategies that hold less-liquid stocks will have lower capacity. Then we can calculate the excess return of each value strategy relative to the MSCI Europe Small Value Index. Figure 6 presents the results. The evidence points to a negative relationship between fund size and outperformance over a benchmark. This pattern of declining returns to scale appears to be a "stubborn fact" indeed for those who wish to generate significant excess returns from billion-dollar funds.

Figure 6: Higher Capacity Strategies Have Lower Excess Returns (July 1997–June 2018)



Sources: S&P Capital IQ, MSCI, and Verdad analysis.

Also note that the excess returns presented in Figure 6 are not the result of investment skill. Rather, they come from a stronger dose of the value factor among lower-capacity strategies. ...

The implications for investment skill are inescapable. Eugene Fama and Ken French have demonstrated that it is exceptionally difficult to separate luck from skill when evaluating a fund manager's past performance. To the extent that a manager has outperformed their benchmark over a long horizon, it is usually better to assume that they provided stronger doses of some factors (e.g. value, profitability, or momentum) relative to the benchmark, as opposed to attributing their outperformance to skill.

But as a fund gets bigger and more diversified, its dosage of factors gets watered down. So if an investor wants a strategy that offers an excess return above 2% per year, they would be better off focusing on small funds with less than $200 million of capacity, as suggested by Figure 6. No skill would be required from the managers beyond the discipline of staying small and sticking with their strategy.

Conversely, investors who wish to receive over 2% per year of excess return from billion-dollar funds would have to place a lot of faith in their fund manager's skill.

The evidence presented in this article shows a clear relationship of declining returns to scale in fund management. We are not the first ones to point this out. Academic researchers have documented this relationship over decades ....

Our thoughts

As we note on our website under Factors: "Size is one of the three original factors when Fama and French published their three-factor model in 1993 to explain stock returns. Over the long run, small capitalization stocks tend to beat their large counterparts." The S&P 500, Large and Mega (>$100 Billion) Caps, is a subset of

the S&P 1500, which is also comprised of the S&P MidCap 400 and S&P SmallCap 600. The S&P 1500 covers approximately 90% of the U.S. market capitalization. While academics continue to debate whether there is a "pure size effect", it is clearly demonstrated by the relative performance of the S&P 600 and 400 (both of which, unlike the Russell 2000, use a Quality screen) to that of the S&P 500. As shown below, Small (IJR, blue line) beats Mid (IJH, orange line), and both clobber Large (SPY, green line).

HCM's IVA Stock Selection System doesn't directly screen for Market Cap. However, its insistence on heavy Insider Buying, best decile Valuation, and an Analyst check to avoid stocks with deteriorating fundamentals

primarily results in Small Cap stocks. For Fund only clients, and to enhance diversification for clients investing in individual stocks, we use both ETFs and OEFs. Currently the best Factor based ETFs come from BlackRock's iShares suite. As shown above, SMLF, which is highlighted at the end of the above Morningstar study, has outperformed IJR (orange line) since inception.

For Developed Market International exposure we use SMLF's sister ETF, ISCF. It outperforms SCZ (green line), iShares MSCI EAFE Small-Cap ETF, with 9.41 billion in Total Assets.

Neither SMLF or ISCF provides exposure to the Low Volatility Factor. For U.S. stocks we use SMMV. For comparison, we have also added IJR (green line) to its Morningstar chart. SMMV is clearly less volatile, and is now outperforming since inception. Due to its greater liquidity with 1.65 billion in Total Assets, we are still using XSLV (orange line), Invesco S&P Small Cap Low Volatility ETF, as a Transitional Fund. For clients for whom we buy individual stocks we gradually replace Transitional Funds as opportunities arise. There is currently no Small Cap Low Volatility Fund for International stocks.

iShares Edge MSCI Min Vol USA Small-Cap ETF SMMV

Last Price	Day Change
$32.39	↑0.17 | 0.52%

As of Fri 02/22/2019 4:10 PM EST |USD

Intraday Indicative Value
$32.42 ↑0.15 | 0.46%

As of Fri 02/22/2019 4:29 PM EST |USD

NAV	Open Price	Day Range	52-Week Range	12-Mo. Yield	Total Assets	Expenses
32.42 USD	32.42	32.32-32.47	27.81-33.40	1.61% USD	103.75 mil	0.20%

Prem/Discount	Volume	Avg Vol.	SEC Yield%	Bid/Ask/Spread	Category
-0.11%	16436	17,396	1.80	0.00/ 32.51/ 200.00%	Small Blend