Quantitative Portfolio Strategy

23 July 2010 | 16 pages

Size and Systematic Effects

Quant ☑

Stock Specific Effects More Pronounced In Small Cap Space

- **Hunting for Alpha** — In this report, we look at the relative importance (and opportunity to add-alpha) of stock selection decisions in the Small Cap space (versus Large Caps).
- **Using macro factors to decompose returns** — For our analysis, we have used macro factors from our APRAM model to decompose stock effects into systematic and unsystematic components over time.
- **Macro factors more important for Large Caps** — Our analysis indicates that a larger component of Large Cap returns can be explained by movement in macro factors as opposed to Small Cap, indicating a lower stock-specific component.
- **Small Caps deviate further from the Index** — Random portfolios constructed from within the Small Cap universe have noticeably higher tracking errors relative to their Large Cap counterparts, suggesting higher levels of active risk.
- **Greater dispersion in stock returns for Small Caps** — The mean standard deviation of *cross sectional idiosyncratic returns* in the Small Cap space is 7.75% compared to 5.05% in the Large Cap space, indicating a larger dispersion in stock returns – a prime candidate for stock pickers.
- **Larger spread amongst Winners and Losers** — Top-Bottom decile spread in Small Cap returns is 22.27%, which compares to 17.22% for Large Caps, reiterating our assertion above that the Small Cap space holds promise for active stock picking.
- **Result: Active management more gainful for Small Caps** — Our results suggest active fund management and the importance of stock-picking is greater within the Small Cap space (as opposed to asset allocation and macro-level allocation decisions).

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See Appendix A-1 for Analyst Certification, Important Disclosures and non-US research analyst disclosures.

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The Small Cap Effect

Ever since Rolf Banz[1] discovered the "small cap effect" in 1979, the issue of whether the outperformance of Small Caps over Large Caps can be monetized or not has been a hotly debated topic in academia as well as in the fund management industry.

A number of reasons have been put forward for the observation of this phenomenon:

- Traditional beta calculation doesn't take into account the cost of infrequent trading and other circumstances specific to Small Caps. Once accounted for, the excess returns more or less disappear[2];
- Markets are inefficient thus Small Caps are persistently underpriced, leading to higher returns;
- Size itself is a risk factor – as proposed by Fama and French[3] in 1992.

The debate concerning the relative returns of Large Caps versus Small Caps is far from over and rather than take sides, we decide to look at this issue from a different angle.

The fundamental question, which we aim to answer with this piece of research, is: *Whether active management is more gainful in Small Caps as compared to Large Caps*?

[1] Banz, Rolf W., 1981, *The relationship between return and market value of common stocks*, Journal of Financial Economics 9, 3-18.

[2] Roger G. Ibbotson, Paul D. Kaplan, and James D. Peterson, 1997*, Estimates of Small Stock Betas Are Much Too Low*, Journal of Portfolio Management 23,104-111.

[3] Fama, Eugene F., French, Kenneth R., 1992, *The Cross-Section of Expected Stock Returns*, Journal of Finance 47, 427–465.

Macro Effects

Macro-economic factors explain a greater proportion of returns in the Large Cap space…

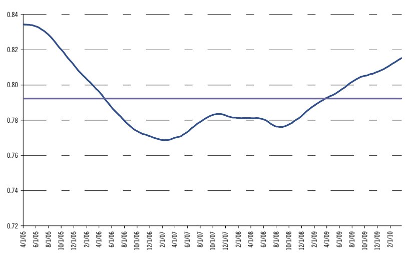
…although the importance of macro-drivers has been increasing

The first step towards answering our question is to examine the impact of macro-economic factors on Small and Large Cap returns. For this we perform a panel regression on weekly returns of stocks in the Small and Large Cap universe against macro factors used in our APRAM model[4].

While macro factors explain a similar amount (of the stock price movements) at the Index level (S&P APxJ PMI for Large Caps and S&P APxJ EMI for Small Caps), with the R-Squared close to 60%, the picture at the stock level is significantly different.

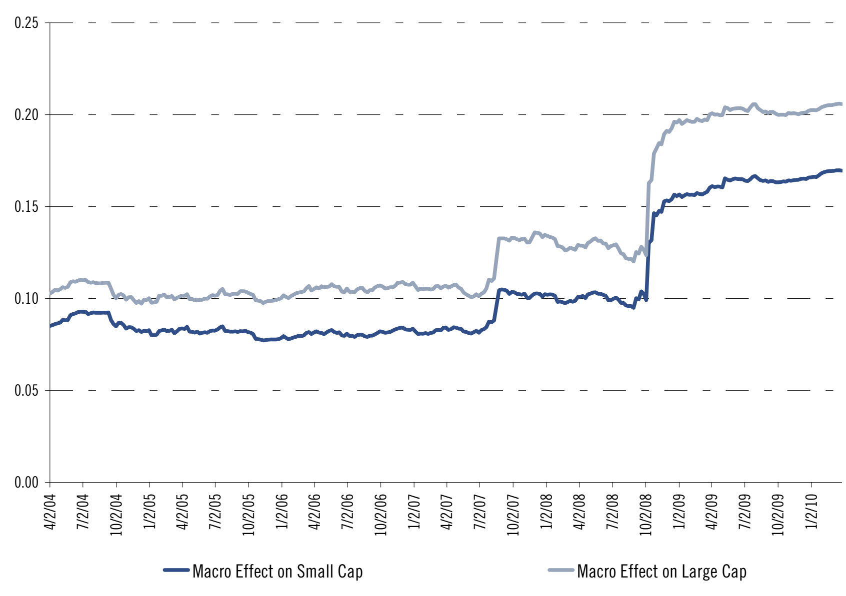
Mean R-Squared (which can be seen as a measure of explanatory power) of the above regression was around 13% on average for Large Caps and 10% on average for Small Caps (Figures 1 and 2)[5].

Figure 1. Macro more important for Large Caps



Source: Citi Investment Research and Analysis

Figure 2. Contribution of Macro Factors to Returns



Source: Citi Investment Research and Analysis

But as Figure 1 (which looks at the ratio of the mean systematic R^2 in the Small Cap space relative to the Large Cap space) shows, the importance of macro effects is consistently greater in the Large Cap space. It is also worth noting that more generally, since 2008 macro effects have become more pronounced everywhere.

To shed more light on these effects we have also analyzed the tracking error of randomized portfolios in the Small and Large Cap space against their respective indices (S&P APxJ PMI for Large Caps and S&P APxJ EMI for Small Caps).

[4] See Appendix 1 for macro factor details.

[5] The Ratio plot for any measure reported is always Small Cap vs. Large Cap.

Tracking errors among Small Cap portfolios (based on analyzing randomized portfolios) are larger...

...which highlights the need for more active management for a risk constrained, benchmarked fund

For calculating tracking errors, we employed the Monte Carlo Simulation to generate 10,000 fully randomized portfolios (both stocks and their weights) with a monthly rebalancing schedule. These portfolios were then regressed over respective benchmarks (S&P APxJ PMI for Large Caps and S&P APxJ EMI for Small Caps). The Standard Error of Estimate (SEE) of these regressions serves as our measure of tracking errors.

Our results indicate that the tracking error in the Small Cap portfolio was approximately 3.75% (monthly), about 1.5 times greater than that in the Large Cap space (the corresponding number being 2.57%).

This suggests that a risk constrained, benchmarked but active investor will likely need to be more pro-active if he is to keep within his risk budget.

Figure 3. Contribution of Macro Factors to Returns

	Small Caps	Large Caps
Mean Systematic R-Square	10%	13%
Median Systematic R-Square	9%	11%
Mean Unsystematic R-Square	90%	87%
Median Unsystematic R-Square	91%	89%
Tracking Error (Monthly)	3.75%	2.57%

Source: Citi Investment Research and Analysis

Unsystematic Returns

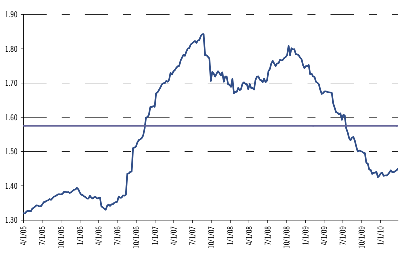
Decomposing returns using our risk model allows us to examine idiosyncratic or stock-specific returns

The dispersion amongst these stock-specific returns is 1.5 times larger in the Small Cap space

Another output from the regression we performed (on stock returns versus macro factors) is the idiosyncratic (stock specific) component of the stock's return. Analyzing these returns highlights a striking difference between the Large Cap and Small Cap space.

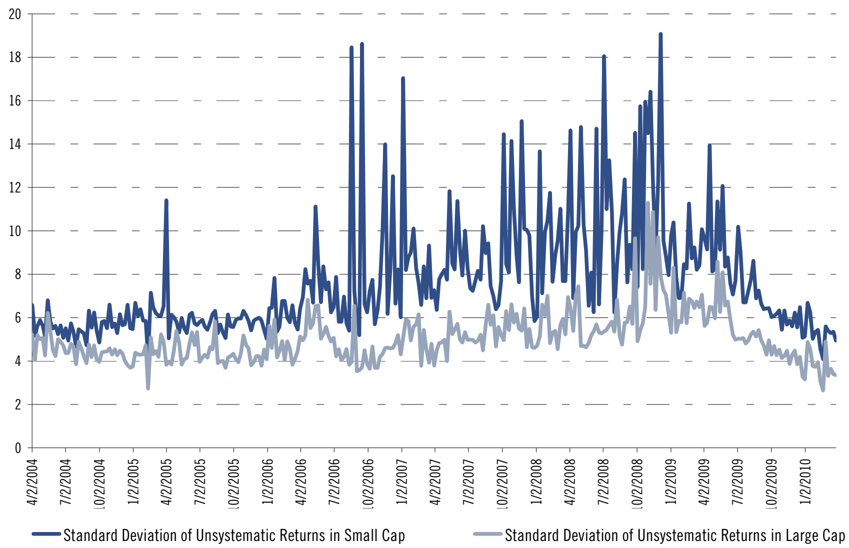
The first step in our analysis of the idiosyncratic returns is simply to look at the magnitude of these returns. Small Caps consistently showed a higher cross-sectional standard deviation in unsystematic returns, with a mean of 7.75%, which is roughly 1.5 times the Large Cap figure of 5.05% (Figures 4 and 5).

Figure 4. Stock Specific effects consistently higher in Small Cap space



Source: Citi Investment Research and Analysis

Figure 5. Standard Deviation in Unsystematic Returns



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The higher standard deviation indicates that if one is able to pick the stocks correctly, then the opportunity set for outperformance is larger in the Small Cap space as compared to Large Caps.

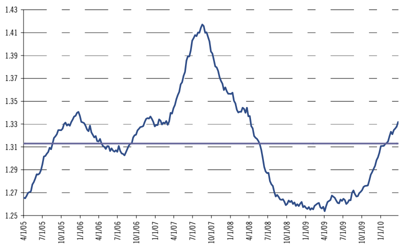
As one would expect decile spread also shows up as a larger difference between Small Cap winners and the losers

Decile Spreads

Another way of looking at the stock-specific returns is to track the spread between the "winners" and "losers" in each space by looking at the spread between the top and bottom decile idiosyncratic returns for both universes.

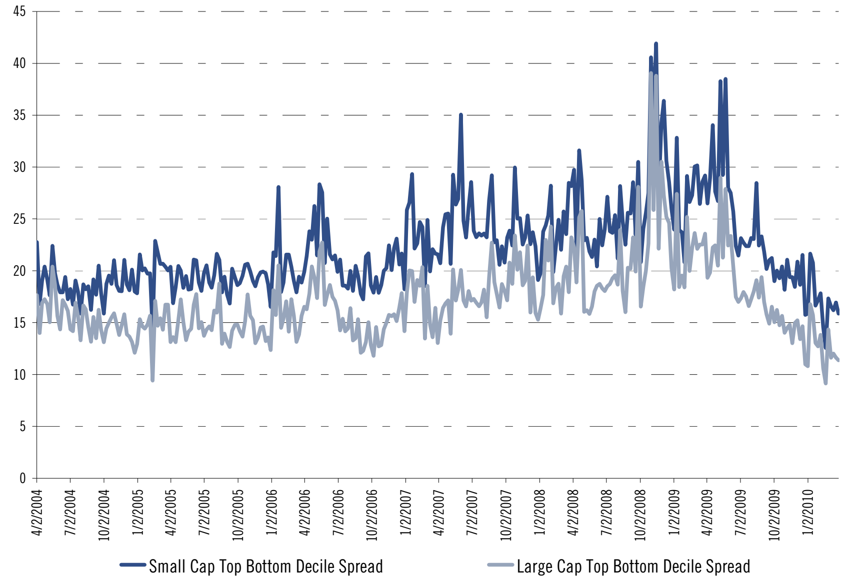
The Small Cap space consistently shows a higher top-bottom decile spread of unsystematic returns as compared with Large Caps (Figures 6 and 7). The mean spread in Small Caps was roughly 22.27%, while for Large Caps the same was around 17.22%. It is worth noting that with the rise in systematic effects over the last two years or so, the decile spread for both has narrowed, although the Small Cap spread continues to exceed that of Large Caps.

Figure 6. The dispersion in idiosyncratic returns is higher in the Small Cap space



Source: Citi Investment Research and Analysis

Figure 7. Top-Bottom Decile Spreads



Source: Citi Investment Research and Analysis

In effect, this reinforces our earlier conclusion that the opportunity to distinguish on performance by making the right stock decisions is greater in the Small Cap space.

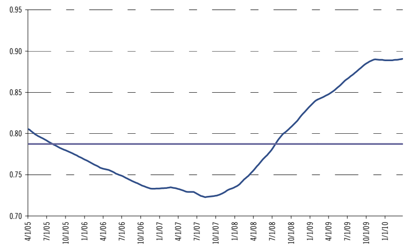
Average Cross Sectional Correlation

Small Cap returns are less correlated, which means taking active stock bets is more important and the possibility to differentiate on performance through stock-selection is higher

The final piece of our puzzle comes from the average cross sectional correlation between stocks in the two universes. The average cross sectional correlation in the Small Cap universe remains consistently lower than in the Large Cap universe (Figures 8 and 9).

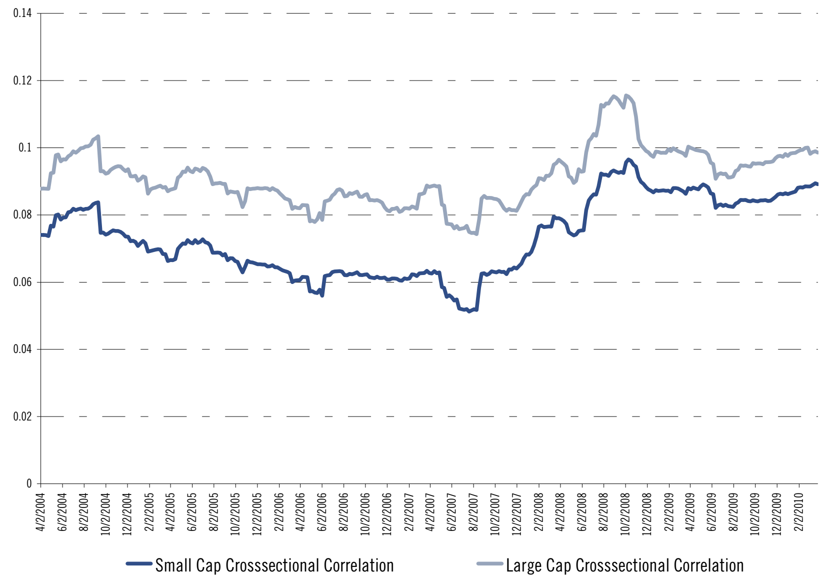
This is in line with our earlier observation regarding the larger dispersion in returns in the Small Cap space, indicating a greater propensity for Small Cap stock returns to diverge (amongst themselves), therefore highlighting a need for more active management.

Figure 8. Small Caps are less correlated as an asset class



Source: Citi Investment Research and Analysis

Figure 9. Mean Cross Sectional Correlation in Unsystematic Returns



Source: Citi Investment Research and Analysis

Conclusions

Figure 10. Summary Results

	Large Cap (L)	Small Cap (S)	Ratio (S/L)
Mean Systematic R-Square	0.13	0.1	77%
Mean Unsystematic R-Square	0.87	0.9	103%
Standard Deviation of Unsystematic Returns	5.05	7.75	153%
Top Bottom Decile Spread	17.22	22.27	129%
Average Cross Correlation	0.09	0.07	78%
Tracking Error	2.57%	3.75%	146%

Source: Citi Investment Research and Analysis

We have – through various methods – tried to examine whether Small Caps offer any benefit over Large Caps for active portfolio managers, and our answer is a confident 'Yes'. Small Caps: 1) have a larger dispersion of returns in the top versus bottom performers, 2) are less correlated amongst themselves (indicating a better space for stock picking), 3) show a higher stock-specific return component, and 4) have a larger deviation in unsystematic returns.

Our results – summarized in Figure 10 – indicate that an active management approach can be more gainfully employed in the Small Cap space as compared to the Large Cap space.

Appendix 1: Macro Factors

US credit spread: Moody's BAA corporate bond yields spread over the 10 year US Treasury bond yield.

Oil: Price of Crude Oil in USD

Commodities ex energy: GSCI Non-energy Commodities index

Short rate: Market capitalization weighted Asia Pacific short term rate

Exchange rate: Asian currency basket against the US$

Long rates: JP Morgan Emerging Markets Bond Yields

Figure 11. Mean Beta Loadings to Macro Factors

	Intercept	Exchange Rate	Long Rates	GSCI ex Oil	US credit	Short Rates	Oil
Large Caps	0.473	1.12	-0.149	0.101	-0.165	-0.177	-0.013
Small Caps	0.482	1.08	-0.124	0.093	-0.169	-0.178	-0.004

Source: Citi Investment Research and Analysis

Appendix 2: Methodology

We use the following regression:

$$R_i^t = \alpha_i^t + \sum_{f=1}^{k} \gamma_f^t \beta_{f,t}^i + \varepsilon_t^i$$

Where:

R_i^t = return of stock *i* at time *t*

α_t = intercept term

γ_f^t = Return of the macro factor *f* at time *t*

$\beta_{f,i}^t$ = sensitivity of stock *i* to factor *f* at time t

ε_i^t = idiosyncratic/unsystematic returns of stock *i* at *t*

k = number of factors

We used panel data (cross sectional + time) with a rolling window of three years (which is 156 data points of weekly returns) for the regression.

We calculated the explanation of the returns by macro factors as the mean cross sectional R-Square as measured at any time point t.

The rest of the calculation was done on ε_i^t, which represents the unsystematic returns after the regressions, which are:

- Cross Sectional Unsystematic Standard Deviation;
- Top-Bottom Decile Spread;
- Average Cross Sectional Correlation.

Appendix A-1

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