Small Is Beautiful

An attempt to quantify the comparative disadvantage of large asset managers.

Stan Beckers and Greg Vaughan

In investment management, success can be self-defeating. Managers who outperform will typically draw in significant new monies from clients who want to profit from their added-value strategies. As growing amounts of money are invested according to the same recipe, portfolio managers lose flexibility; it becomes harder to switch in and out of positions. Executing a desired trade will take longer or create adverse market impact price moves. The resulting reduction in the speed and nature of the portfolio adjustments will ultimately impair portfolio performance.

These diminishing returns to scale lead to opposing interests for asset managers and their clients. As long as management fees are calculated as a percentage of assets under management, the manager's prime commercial interest is to grow the asset base. The client, on the other hand, is interested in above-benchmark performance, which ultimately will require a limit on the assets allocated to a given strategy.

So far little attention has been paid to the natural depth of individual investment strategies. The industry at large and asset consultants and pension trustees in particular have actually tended to see large amounts of assets under management as a positive, especially when size has been combined with recent good performance (for some dissenting voices, see, for instance, Bogle [1996] and Wheeler [1998]).

Fattening the goose that has laid the golden eggs, however, will eventually lead to an unhealthy and unproductive animal. It behooves asset managers and consultants to have a clear idea as to at what point growing the asset base will start destroying the strategy.

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We endeavor to shed some light on the importance of fund size as a potential detractor of investment performance. We quantify how soon and how significantly size starts to eat into performance. We identify the exact causes of this performance drag and explore what the repercussions are for the merits of industry consolidation.[1]

THE LABORATORY

Many factors affect investment performance. It is therefore virtually impossible to distill the pure impact of fund size on potential value-added; there simply are no two funds that are identical, except for their size. Cash inflows and outflows, investment strategy, tracking error and constraints, the timing and efficiency of trading, and the vagaries of the market will inevitably lead to differential outcomes over and beyond those that may be attributable to the size of the fund.

We therefore opt for a historical simulation where we can control all these confounding influences. We create hypothetical managers who follow exactly the same strategy, with the same skill and the same time frame but varying fund sizes. The simulation is based on real market data, taking into account the market depth so that we execute at prices and in volumes that could have been achieved in the marketplace.

The data we use consist of the daily prices and trading volumes for the 250 stocks that made up the Australian All Ordinaries index over the three-year period ending September 30, 1999. The benchmark for the strategy is the ASX 100 (roughly the cap-weighted average of the top 100 stocks). Our strategies and portfolio sizes are expressed in terms of percentage of market capitalization. Therefore the insights we derive can be directly translated to other developed markets.

Portfolios get rebalanced on a weekly basis, using a multiple-factor optimization procedure. The optimization trades off active returns (alphas) against tracking error (residual risk), taking into account realistic trade execution costs and limits. We also implement fairly tight stock-level, sector-level, and capitalization-level constraints so that the resulting portfolios all have a tracking error of around 2%.

The Alpha Engine: Fast Ideas and Slow Ideas[2]

If we accept that growing a fund will slow down the speed of execution, then the lifespan of our alphas will crucially determine whether and to what extent one can add value. Our simulated investment strategy uses a combination of slow-moving (value) and fast-moving (momentum) style factors. The relevance of these factors is well established by both academic and industry research (see for instance, Capaul, Rowley, and Sharpe [1993], Chow and Hulburt [2000], Fama and French [1998], or Jones and Winters [1999]).

The *value* alpha is based on the traditional measures of fundamental value such as dividend yield, P/E, book value/market value, and cash flow/price. We forecast how these characteristics will be rewarded and tilt our portfolio accordingly. A value-tilted portfolio will not change significantly through time, as value stocks typically do not change their stripes at short notice. In our simulation, a pure value portfolio would have a 50% annual turnover (i.e., the portfolio would get turned over once every two years).

Momentum is a faster moving information source. Its main ingredient, short-term price momentum, changes almost continuously. Our momentum measure is a combination of the price trend over the last week and the last six months, implying that markets respond gradually to new information (Chan, Jegadeesh, and Lakonishok [1996]). A strategy that exclusively tilts the portfolio toward this momentum exposure would result in an annual turnover of 250% (i.e., the typical holding period for a stock would be roughly five months).[3]

The third ingredient for our portfolio alphas is based on *earnings revisions* (changes in the consensus earnings forecasts as collected by IBES). Earnings forecasts for individual stocks do change (although mostly gradually). A portfolio strategy solely tilting the portfolio toward (away from) stocks with positive (negative) earnings revisions would have an annual turnover of about 300%.

The portfolio strategy can be described as style-based. We create portfolios with a certain value, earnings revision, and momentum profile according to how well we think each of these ingredients will be rewarded. Stocks are chosen because they help us create this desired portfolio profile. Our strategy is agnostic about any other stock-specific desirable or undesirable features.

The three favored style factors are chosen with the benefit of hindsight, because we know that these characteristics added value to the benchmark over the three-year period. This ex post selection bias should not be a cause for concern; we are not interested in identifying a successful strategy but in the loss of efficiency resulting from implementing a winning strategy for funds with different sizes.

Our strategy is based on a weekly forecast of the returns associated with these three factors. The strategy gives more weight to the slow-moving value characteristics than to the momentum or revision signals. The resulting portfolios have an annual turnover of around 80%. Although portfolios are rebalanced on a weekly basis, the amount of rebalancing is therefore typically low (1.5% average turnover every week, 6.5% every month).

The exact nature of the alphas in the context of this study is of secondary importance; it is their rate of change that matters. Indeed, it is the speed of portfolio adjustment relative to the speed of the information change that will mainly determine how much efficiency gets lost as funds grow in size. We would therefore argue that the insights we derive can be generalized to any portfolio strategy that has an annual one-way turnover of around 80%. This is an annual turnover that is roughly reflective of a large cross-section of institutional investment styles.

Investment Constraints and Target Tracking Error

We want to make sure that both large and small funds will broadly follow the same strategy. In particular, we want to avoid an investable universe that significantly discriminates between large and small funds. In other words, we want to guard that our conclusions not become confounded by the fact that smaller funds could load up on smaller companies, while large funds (given the weight of their money) couldn't significantly overweight small-cap stocks. Our portfolio optimizations therefore impose stock-level, sector-level, and capitalization-related constraints and penalties.

At the stock level, the top 50 stocks can be over- or underweighted by a maximum 2 percentage points relative to their benchmark weight. These constraints tighten (almost linearly) as the capitalization drops, so that the smallest stocks in a 250-stock universe can be overweighted by 0.5%. In other words, smaller funds do not have the comparative advantage of heavily overweighting any individual small-cap name.

We also ensure that our portfolios are broadly sector-neutral, allowing a maximum 1 or 2 percentage point (depending on the market capitalization) sector weight deviation from the benchmark. Finally, we avoid significant size biases by imposing a maximum 3 percentage point deviation from the benchmark weight for each of the top 50, the 51 to 100, and the over 100 capitalization bands.

The resulting portfolio—by its very nature—will be tied closely to the benchmark, with a typical annual tracking error of around 2 percentage points. By imposing these tight constraints we ensure uniformity of style, philosophy, and implementation across the various fund sizes. The portfolio tracking errors are consistent across the entire range of funds and broadly made up of the same ingredients. Performance differences will therefore mainly arise from the greater flexibility that smaller funds have in trade execution.

Trade Execution

Our trade simulation is designed to ensure that we trade within the limits of what the market can accept and at prices that would actually have been achieved in practice. Avoiding market impact is a prime trading consideration. In fact, it is generally accepted that market impact costs resulting from careless trading are several orders of magnitude greater than the direct costs and would destroy a large proportion of the ex ante alpha (Stoll [1993]). Conversely, thoughtful trade execution (execution that minimizes the effects of market impact) can be a source of significant competitive performance enhancement (Wagner and Banks [1992]).

The impact-free volume for any stock typically varies between 15% and 25% of the average daily volume. The exact percentage is determined weekly on a stock-by-stock basis by ITG Australia using its proprietary algorithm to forecast market impact.[4]

The weekly optimizations set a hard trading volume constraint for each stock, equal to the impact-free turnover that can be expected to be executed over the next week (i.e., five times the daily expected impact-free turnover). This turnover constraint will bias the larger funds toward more liquid stocks to achieve the desired style profile. For example, if the impact-free trading volume on a particular stock valued at $6 is 100,000 shares, we impose a $3 million trade limit on this stock for the next week.

For a manager with a fund size of $600 million (roughly 0.1 % of market cap), this trade represents 0.5% of the fund value. For a fund that is ten times larger, the allowed trade represents only 0.05% of portfolio value. Hence, the smaller fund has more flexibility to give the portfolio its desired shape, while the larger manager will realize a greater proportion of its turnover in more liquid stocks. To the extent that both large and small funds want to make the same trades, large funds will hit the daily impact-free turnover limit more often than small funds, and will therefore execute over more days than smaller funds.

In short, increased fund size restricts the opportunity set; larger funds are not able to fine-tune their portfolio profiles to the same degree as the smaller ones. Larger managers will trade fewer stocks than smaller funds (a number of trades will not be economical for them), and when they trade, they trade more slowly. The bottom line is that size entails transaction handicaps that ultimately will lead a larger manager to achieve smaller alpha improvements.[5]

Note that the turnover constraint will not ensure that our (assumed no-impact) daily trade will not incur any market impact costs. In fact, it does happen that trading volume during the subsequent week is below average such that our targeted trades would normally incur a market impact cost. This cost is explicitly taken into account; trades that do not break the impact-free daily volume limit are assumed to be executed at VWAP (volume-weighted daily average price). Those that exceed this limit incur a market impact price increase over VWAP. This market impact price increase is again derived from ITG's market impact model.

Setting the daily trading target to be within the impact-free limit entails that large funds take longer to fill their orders. Executing a trade over more days will hurt when the price moves against you (i.e., when there is short-term adverse price drift). Short-term overreaction is well documented in the academic literature (see, for instance, Bremer and Sweeney [1991]). We model this expected price drift using a residual reversal model. At the end of each week, we identify the stocks that were overbought (positive residual return) and those that were oversold (negative residual return).[6] In our portfolio optimization, we then filter out all trades that involve selling of oversold stocks against buying of overbought stocks. This then leaves only possible trades where the trend is working in our favor (although the strength of the trend will weaken as the week progresses).

Our trade execution is generally designed to minimize market impact and to take advantage of short-term residual reversal effects. Both large and small funds try to minimize market impact and to benefit from short-term price drifts. Small funds have the advantage that they execute more quickly, therefore running less of a risk to incur a market impact cost on any given day. Smaller funds will also be able to pick up residual reversals early on, while larger funds may still be trading when this effect has run its course.

Finally, it should be noted that both large and small funds incur normal commissions and taxes at 0.30% of the traded value.

The Simulation

The simulation is designed to analyze the impact of fund size on investment performance. The portfolio size is determined as a percentage of market capitalization: The smallest fund is assumed to manage 0.1% of the market capitalization (roughly equivalent to AU$ 600 million), and the largest manages 2% of the total market value (AU$ 12 billion).

An initial optimization, ignoring transaction costs, establishes the manager's preferred starting portfolio. Every Friday the portfolio is reoptimized in light of the new style alphas that have been generated. The turnover constraint also is reset, taking into account the recent trading history of each stock, which leads to a targeted trading volume that should be executable over the next week without any market impact. The trades are executed over the subsequent week, trading daily, and executing at VWAP (adjusted for market impact if necessary). All trade executions are based on actual historical price and volume data.

Investment constraints on stocks, sectors, and capitalization bands remain unchanged over the entire simulation period. The simulation involves 156 weekly rebalancings for five different portfolios.

THE RESULTS

Exhibit 1 summarizes the net return over the benchmark for each of the various fund sizes. The results are surprising in their magnitude. A manager who manages 2% of the market cap loses 2 percentage points in potential value-added and more than half of its information ratio in comparison to a manager who manages a fund that is 20 times smaller. More important, the loss in efficiency is noticeable at a very early stage in the fund's growth. Indeed, an increase of the asset base from $600 million (0.1%) to $ 1,500 million (0.25%) entails a loss of 0.68 percentage point in alpha and a drop in the information ratio of 0.22.

Note that the information ratios that are reported here are inflated by the ex post selection bias; that is, we bias our portfolios toward styles that have worked over our simulation period. A more realistic small-cap information ratio would probably be in the neighborhood of 0.5 to 0.75. All other information ratios would also scale down accordingly.

EXHIBIT 1
NET ACTIVE RETURN BY FUND SIZE

Fund Size as a % of Market Capitalization	Net Active Return	Tracking Error	Information Ratio*	Annual Turnover
0.10%	3.22%	2.54%	1.26	82%
0.25%	2.54%	2.44%	1.04	78%
0.50%	2.23%	2.35%	0.95	75%
1.00%	1.98%	2.22%	0.89	71%
2.00%	1.21%	2.24%	0.54	68%

The information ratio is a measure of value-added and is equal to the active return (annual return over the benchmark) divided by the realized active risk or tracking error (standard deviation of the active return). For a detailed discussion of the information ratio, see Goodwin [1998].

It is also interesting to observe that the larger managers ex post operate at slightly less tracking error than their larger colleagues. This is because the smaller managers reach their maximum targeted active positions more quickly than their larger colleagues. Smaller funds will be able to trade to the desired position almost immediately, while the larger funds will adjust their positions more gradually. This reduction in flexibility is also noticeable in the annual turnover levels; the typical turnover drops as the fund size increases, since larger funds trade more slowly.

Performance Attribution

A detailed performance attribution of the active returns allows for a more insightful analysis of the results. Performance attribution allocates the active return to the relevant components of the investment process, such as market timing, style and sector biases, and stock selection. Our investment strategy is broadly market- and sector-neutral. The main sources of added value are the short-term reversal effect and the factor-related style biases. Individual stock-specific effects also contribute to the active return.

The details of the performance breakdown are summarized in Exhibit 2. We can draw several conclusions

The residual reversal trade filtering provides a significant advantage for the smallest fund, with an active return contribution of 0.62%. This is because small managers' trades are mostly completed earlier in the week before the reversal effect has run its course. This advantage tapers off with size and—although still substantial—does not provide a major return differentiation beyond the smallest size category.

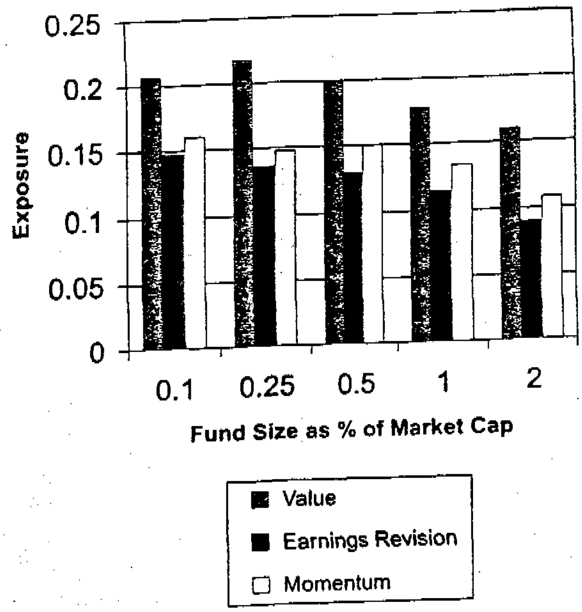
The larger managers do not succeed in implementing the desired fund style profile as efficiently as the smaller ones, leading to a reduction in the value-added contribution from style. Although both large and small managers target the same style profile for their portfolio, the larger managers find it harder to achieve their target. Since portfolio adjustments become more cumbersome and time-consuming with size, smaller funds will have a more pronounced style identity.

Exhibit 3 illustrates the loss in a fund's ability to build up a distinguishing style profile as size increases. It shows the average style bias over the three-year period for each of the funds. As size increases, maintaining the value bias is not that difficult (the largest fund can maintain about 78% of the exposure of the smallest fund). Implementing the earnings revision and momentum exposures is somewhat harder, with the large fund manager achieving only 60% to 65% of the style exposure of the smallest fund.

EXHIBIT 2
PERFORMANCE ATTRIBUTION

	Active Return due to				
Fund Size as a % of Market Capitalization	Reversal Filtering (1)	Style (2)	Sum (1) + (2)	Information Ratio (1) + (2)	Stock Selection
0.10%	0.62%	2.42%	3.04%	1.25	0.18%
0.25%	0.29%	2.07%	2.36%	1.01	0.18%
0.50%	0.27%	1.74 %	2.01%	0.89	0.22%
1.00%	0.28%	1.45%	1.73%	0.81	0.25%
2.00%	0.20%	0.90%	1.10%	0.52	0.11%

EXHIBIT 3
FACTOR EXPOSURE BY FUND SIZE



The factor exposure is measured in terms of cross-sectional standard deviation from the market average. For example, if the characteristic in question is P/E, we might observe that the market average P/E is 15 with a cross-sectional standard deviation of 5. If a portfolio has an average P/E of 16, it would have an exposure of 0.20 relative to the market [(16 – 15)/5].

In other words, value managers can—all other things equal—better cope with a growth in funds under management. Managers implementing faster-moving signals will on the other hand find it harder to maintain their desired style exposure as the fund size increases. This reduction in style exposure contributes to the drop in tracking error as fund size increases.

The stock-specific return is that fraction of the outperformance attributable to company-specific circumstances. This return is unrelated to the style investment process and therefore incidental. In our simulation, stock selection contributes positively to each fund's active return. Its impact is random, and should therefore be ignored when evaluating the loss in flexibility associated with growth in size.

The true impact of the reduction in flexibility is captured by the sum of the benefit of "reversal filtering" and "style" return. The impact of growth in funds on active return is as noticeable for smaller portfolios as it is for larger ones. On average, a doubling of funds under management reduces the active return by 0.5 %. Even more important, the information ratio declines monotonically. A quadrupling of the asset base destroys roughly 35% of the ability to add risk-adjusted value, with the effect becoming more pronounced for larger funds.

Transaction Costs

All the results presented so far are net, after direct and indirect transaction costs. The effect of direct transaction costs (commissions and taxes) is somewhat immaterial in this context. Larger funds do have a slightly lower turnover, but the associated cost advantage is somewhat muted. Given direct costs of 0.30%, a manager whose turnover is 15% below than that of a colleague will see a net benefit of 0.09% per year (2 × 0.30 × 0.15). This net benefit is already reflected in our performance numbers.

Direct transaction costs tell only part of the story, and are typically dwarfed by the invisible indirect costs (Treynor [1994]). We quantify these indirect costs by comparing the price used to reach a trading decision to the actual execution price. The execution price is normally the volume-weighted average price (VWAP) for the stock on the day of the trade. When the targeted volume on that trade day exceeds the impact-free volume for that day (because market liquidity in the stock is exceptionally low), the VWAP price is increased with the estimated market impact adjustment.

The realized indirect transaction cost is the difference between the (adjusted) VWAP and the price used in the portfolio optimization to decide on the trade. This percentage difference is adjusted for the market movement since the date of the portfolio optimization. For example, if the optimization is based on Friday's closing price of $5.00, and the stock is bought the following Monday at a VWAP of $5.10, the indirect transaction cost before market adjustment would be 2%. If the average index level on Monday is 1.5% higher than the Friday close, then the market-adjusted indirect cost would be 0.5%. If the stock is sold rather than bought, the calculated indirect cost would be –0.5%. Exhibit 4 summarizes the annual indirect transaction costs.

EXHIBIT 4
INDIRECT TRANSACTION COSTS

Fund Size as a % of Market Capitalization	Indirect Transaction Costs (annual)
0.10%	0.40%
0.25%	0.31%
0.50%	0.44%
1.00%	0.46%
2.00%	0.33%

EXHIBIT 5
ACTIVE RETURN AND INFORMATION RATIO BY FUND SIZE AND TRACKING ERROR

Fund Size as a % of Market Capitalization	Ex Ante Tracking Error 2% Active Return	Ex Ante Tracking Error 2% Information Ratio	Ex Ante Tracking Error 4% Active Return	Ex Ante Tracking Error 4% Information Ratio
0.10%	3.04%	1.25	4.45%	1.00
0.25%	2.36%	1.01	3.26%	0.75
0.50%	2.01%	0.89	2.09%	0.49
1.00%	1.73%	0.81	1.57%	0.38
2.00%	1.10%	0.52	0.86%	0.21

Interestingly, the indirect transaction costs do not show a consistent pattern across the different fund sizes. The portfolio optimizations consciously try to avoid trade sizes that will exceed the impact-free limit. Both large and small funds are therefore equally exposed to the price drift between Friday's closing price and Monday's VWAP and to the possibility of exceptionally low liquidity in any given stock.

These transaction cost results confirm that our simulations achieve their objective; our strategies are designed for a low-impact execution that would not unduly advantage one type of fund over another. The "cost" of the growth in funds is incurred by trading more cautiously, resulting in a lower alpha due to a less efficient implementation of the portfolio strategy.

It should also be emphasized that our simulations are based on a highly sophisticated transaction cost management strategy. Managers who pay less attention to efficient execution will incur significant market impact costs. Unsophisticated execution will hit large managers harder than smaller ones (given the weight of their money). In this respect, we think that our simulations have established a lower bound on the comparative advantage of smaller fund sizes.

THESE RESULTS IN PERSPECTIVE

The results indicate that there is no such thing as optimal fund size, in that the potential to add value invariably drops as a fund grows. In this respect, the growth of assets under management has the same effect as increasing the tracking error of the strategy. In both cases there is a loss in efficiency.

Growth of the asset base leads to slower and less flexible execution. An increase in the tracking error leads to lower information ratios, since not all of the active positions are perfectly scaleable (most notably since long-only funds are restricted in the extent to which they can underweight individual positions).[7]

Most fund managers have a tendency to resist a client demand for a more aggressive implementation of their ideas, arguing that this will potentially reduce the effectiveness of the strategy. Few of these same managers will turn away new assets, despite the fact that the impact on the effectiveness of their strategy is similar. Exhibit 5 compares these losses in efficiency for different levels of tracking error.

Growth in the assets under management has a more dramatic impact on the more aggressive strategies. Adding value becomes increasingly difficult for growing asset managers with a higher tracking error. Alternatively, a manager who has an absolute outperformance target (such as to add 2% to the benchmark return) will have no option but to become more aggressive as its asset base grows. This is the fundamental problem of asset-based fees: Successful managers need to take on more active risk to continue to deliver the same level of outperformance. These asset-based fee structures are thus perverse in that they contribute to the destruction of the ultimate source of success.

THE INSIGHTS

We have documented that a manager's task of delivering value-added becomes harder as a fund's asset base grows. This is because bigger funds lose flexibility in implementing their ideas. Trading will take longer when the fund gets bigger. This delay detracts from performance as the opportunities vanish with the passage of time. The resulting performance drag is pretty much unavoidable.

Key observations from our analysis are as follows.

Maintaining a desired style profile becomes harder as fund size grows. This is particularly true for momentum style managers. It is therefore safe to conclude that momentum styles are less scaleable than value-based strategies. We would conjecture that momentum managers will lose their knack more quickly as their asset base expands. The managers who combine value and growth signals would probably need to start favoring value over growth to maintain their alphas as they become bigger.

Net performance worsens with size. This happens from an early stage in a fund's development, and the effect is inevitable. There is thus no such thing as an optimal fund size. Any addition of new funds will make a strategy somewhat less effective. It would not be unreasonable for an asset manager to know how its effectiveness will be affected by the addition of new funds.

A growing asset manager will have to improve its tracking error to continue to deliver the same alpha. Growth in assets under management leads to a drop in information ratio similar to the increase in the tracking error. Managers become less risk-efficient as a fund grows bigger (and as they become more aggressive).

Small and large managers who try to transact optimally will incur virtually the same overall transaction costs. There is no inherent significant transaction cost advantage associated with fund size.

We would question whether the size of the asset base (bigger being better) is a valid manager selection criterion. New monies allocated to smaller managers provide—ceteris paribus—more scope to enjoy continued good performance. All other things equal, large size is a negative rather than a positive.

Asset-based management fees lead to a misalignment of client and manager interests. Performance-based arrangements would lead a manager to question the cost/benefit of new fund inflows more closely.

The asset management industry is going through a significant consolidation phase. If this consolidation results in a more uniform investment style for the amalgamated funds, the net benefit for the client is likely to be negative. A move to standardize client accounts and to reduce style dispersion among them will have a similar effect.

In this simulation we have tried to isolate the impact of fund size on investment performance, and have concluded that small is beautiful. The conclusion is obviously not that small managers will outperform large ones; fund size is only one variable affecting performance. All other things equal, however, a small manager has a sizable comparative advantage.

There may be other benefits associated with being a large fund manager. From a pure investment strategy perspective, though, the race is to the small and nimble players.

ENDNOTES

[1]For an early study on the relationship between fund size and transaction costs see Perold and Salomon [1991].

[2]The classification of styles according to their workout period into fast and slow ideas originates with Treynor [1994].

[3]For the prevalence of medium-term momentum effects in international equity markets, see, for instance, Rouwenhorst [1998].

[4]ITG is a global provider of technology-based equity trading services and transaction research to institutional investors and brokers

The impact-free trade typically varies between 15% and 25% of the daily volume. The exact percentage is determined on a stock-by-stock basis and is a function of: frequency of trades; the spread between daily high and low price; bid/ask spread; the skewness of the daily turnover (i.e., the difference between the median and the mean); and variability of the daily turnover.

[5]The extent to which any individual manager will be affected will of course to a large degree be influenced by its investment style (Keim and Madhavan [1997]). In our study we take the investment style as a given, and vary fund size for a given style.

[6]The residual return of a stock is defined as the market- and sector-adjusted return for the week.

[7]For a discussion of the impact of the no-short selling constraint on a portfolio's information ratio, see Grinold and Kahn [2000].

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