Diversification versus Concentration . . . and the Winner is?

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Abstract: Diversification has its well-known benefits but its pursuit can involve a trade-off between risk and return. We investigate this trade-off by examining the relative performance of diversified versus concentrated portfolios where both are formed on the basis of the same stock preferences. Using US equity mutual funds as our data source, we establish that the most preferred stocks of the typical manager perform extremely well but that at any point in time they are able to identify less than 20 mispriced stocks. The typical US equity mutual fund holds approximately five-times this number of stocks which raises the possibility that the managers' stocks selection skills are heavily diluted in the pursuit of diversification suggesting that investors may be well advised to do their own diversification.

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Harry Markowitz (1952) fathered Modern Portfolio Theory when he informed us about the true nature of risk, and how to benefit associated with holding diversified portfolios. The insights provided by Markowitz soon impacted on portfolio construction and have been progressively embraced by fund managers, their clients and regulators. Of course diversification makes perfect sense as it can be easily demonstrated that the risk attached to a portfolio can be progressively decreased by adding randomly selected stocks to the portfolio (Evans and Archer, 1968). If one assumes that markets are efficient and so all securities can be expected to deliver a zero risk-adjusted return, then there would seem to be no bounds as to the extent that one should diversify.

Of course, there are bounds and they come in the form of transaction costs which will grow as the portfolio is expanded and eventually outweigh the benefits from increment in risk-reduction associated with further expansion the portfolio. Various authors have estimated the optimal portfolio holdings to be no more than eight stocks (Fisher and Lorie, 1970), 15 stocks (Evans and Archer, 1968), 22 stocks (Bird and Tippett, 1986), 40 stocks (Statman, 1987), and 50 stocks (Campbell et al., 2001). The numbers derived in these papers all being promulgated on the assumption that markets are efficient implying that there is no return consequences from further expanding the portfolio size.

In this paper we specifically address the question of whether it is reasonable to expect that managers can continue to add stocks to their portfolio without diluting the portfolio returns. Using US mutual fund data, we rank the stocks held in each fund on

the basis of the preferences of the manager to hold that stock. We then measure the returns generated from portfolios of increasing size based on these preferences. We find good and bad news – the good news being that the managers do have stock selection skills in that the stocks they like best handsomely outperform the fund benchmark; the bad news being that their stock selection ability of the typical manager is limited to identifying between 15 and 20 stocks at any point in time. It is interesting to observe that the typical manager hold 87 stocks in their US equity funds and that the majority of these stocks make a negative contribution to fund performance. We discuss the implications of this for both managers and their clients in the paper.

Some Background

The major advance in our understanding of risk came with the work by Harry Markowitz (1952) on portfolio theory. His insights completely changed the industry's views on portfolio construction by demonstrating that we should no longer assess risk at the level of individual securities but rather in terms of the contribution that each security makes to the risk of the total portfolio. The investment process involves assessing the potential of the securities in our universe to generate returns (stock selection) and then combining these securities in a portfolio to generate acceptable risk-return outcomes (portfolio construction). The work of Markowitz switched our attention back to the portfolio construction phase where risk plays a much more equal role with returns in determining where the funds should be invested. In particular, we learned from MPT the need to diversify our portfolios and by so doing realise the benefits of risk-reduction.

The need to embrace diversification was accepted by the funds management community not only because they were convinced by the propositions of Markowitz. Diversification was also was thrust upon managers as prudent practice by the legal system, the regulators and by their clients. For example, diversification is embedded in the "prudent man" principles that govern fiduciaries[1]. As a consequence, we find that almost all product description statements or investment mandates that govern how funds are invested will have both explicit and implicit statements that drive the manager towards holding diversified portfolios. Therefore it probably comes as no surprise to find that the median portfolio holdings across our whole sample is 87 stocks.

The question that we pose here is whether the benefits associated with diversification comes at too great a cost in terms of foregone returns. The answer is potentially "YES", as there may often be a conflict between investing in stocks solely because they are cheap and investing in sufficient stocks to bring the greatest diversification advantages to the portfolio. It is important to note here that this conflict would not exist in a world where markets are efficient as then there would be no market mispricings to exploit and so portfolio construction is the only game in town. Of course many would disagree about the efficiency of markets as evidenced by the proliferation of active managers and the support that they receive from investors.

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[1] The Employee Retirement Income Security Act ("ERISA") was enacted into law in the US in 1974. ERISA enforces the administration of retirement and benefit plans. ERISA has a Diversification Rule – A fiduciary must diversify investments in order to minimize risk of loss unless it would be considered prudent to not diversify investments. 29 U.S.C. §1104 (a)(1)(C).

Perhaps the best expression of the danger of diversification comes from one of the greatest intuitive investment thinkers of all time, John Maynard Keynes, who in a letter to a friend in 1934 wrote the following:

> *"As times goes on, I get more and more convinced that the right method of investment is to put large sums into enterprises which one thinks one knows something about and in the management of which one thoroughly believes. It is a mistake to think one limit's one's risk by spreading too much between enterprises about which one knows little and has no reason for special confidence."*

The insights provided by Keynes have not been lost on many of the greatest modern day investors, such as Warren Buffet , Charlie Munger and George Soros, who are firmly in the camp of the concentrators[2]. Of course, the one feature that is common to all of these concentrators is their ability to identify opportunities to invest in underpriced securities.

There is an extensive literature on the performance of active funds dating back to the mid-60s. The general finding of these studies is that the active funds as a group underperform their benchmark once account is taken of their management fees and the other incremental costs associated with employing active managers (Jones and Wermers, 2011). Of course, the fact that active management as a whole fails to outperform does not preclude that many managers will outperform their benchmark over any particular measurement period. However given that good recent performance is typically a precondition for appointing a manager, this will only

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[2] Quoting Charlie Munger: "The academics have done a terrible disservice to intelligent investors by glorifying the idea of diversification. Because I just think the whole concept is literally almost insane. It emphasizes feeling good about not having your investment results depart very much from average investment results." Interview with Charlie Munger which can be found at http://www.myinvestmentforum.com/category/sgfunds-forum/interview-with-charlie-munger-t1655.html

translate into value-adding future outperformance for investors if it proves that there is a high level of persistence in manager performance (Gohal and Wahal, 2008). Yet the empirical evidence suggests that there is little persistence in fund performance which adds to the argument that investors would be well advised to delegate the majority of their funds to low costs passive management (Busse et al., 2010)[3].

Common implications drawn from the empirical evidence include that (i) managers as a group underperform on an after-fees basis and (ii) markets are efficient given that highly-paid professional managers are unable to identify mispriced stocks. Diversification makes particular sense if markets are efficient as there should be no expectation of added value from stock selection but (almost) guaranteed risk-reduction as a result of diversification. However, in inefficient markets the arguments in favour of diversification become more problematic as they are no longer independent of the stock picking skills of the managers. Our focus in this paper is on the stock picking skills of managers and especially on their ability to identify sufficient mispriced stocks to form portfolios of the size that they typically hold. We already have some evidence from Cohen et al. (2010) that the very best ideas of managers add value and in this study we extend this analysis to determine the extent of the ability of managers to identify mispriced stocks and the extent to which this talent might be exploitable by investors.

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[3] More recent literature has identified several features of fund that are correlated with positive future performance such as willingness to take active bets relative to benchmark (Cremers and Petajisto, 2009; Bird et al, 2014), willingness to take style bets (Wermers, 2012; Bird et al., 2014), tendency to depart from the pack (Jiang and Verado, 2012) and a low propensity to react to changes in analyst' forecast (Kacperczyk and Seru. 2007). The one theme common to all these findings is that they are likely to describe fund managers who think that they are better than average which suggests that the managers are quite good at assessing their own ability.

Specifically, in this study we take a very simple approach to identify the 30 most preferred stocks held by each fund as a first step to building portfolios based on these stocks weighted in accordance with the extent of these preferences. We extend this analysis to provide an insight into the quantum of mispriced stocks that can be identified by managers. Our findings will provide insights that go beyond the level of diversification that should be incorporated by managers. The first being the insights that it will provide to investors as to how they should best utilise the skills of fund managers. One option that we will consider is that they contract with managers to provide their best bets and then construct their own diversified portfolios based upon these stock recommendations. Our findings will also provide insights into the contributions made by fund managers. The possibility that the average manager has above average stock selection skills brings into question the conclusion drawn from the fund performance literature that as a group they offer little to clients who would be well advised to invest via index funds. A third important implication of our findings relates to the efficiency of markets. If managers display the ability to outperform when running concentrated portfolios, then this suggests that they can consistently identify mispriced stocks. Finally, if we do find evidence to suggest that managers are good at stocks selection, then the question is why does this apparent investment skills fail to translate into better overall investment performance. The suggestion is that the benefits from their superior stock selection skills are typically lost in the portfolio construction stage as a result of including value-detracting stocks in their portfolios in the pursuit of risk-control.

Data and Methodology

Our data set extends from January 1995 to March 2012 with the majority of the data being collected on a quarterly basis[4]. It is important to note that we add back fees to the mutual fund returns in order to make them comparable with the returns we calculate for the concentrated portfolios. Further because we want to deal with diversified portfolios, we deleted from our sample any funds with an average holding of less than 40 stocks.

In total we have 5, 535 active US equity mutual funds that have an average (median) fund size is $276m ($35m) with average (median) fund holding of 148 (87) stocks. There are about seven growth managers for every four value managers with the growth manager being slightly smaller both in terms of funds under management and stock holdings. Finally, there are 1,937 institutional funds and 3,598 retail funds with the retail funds being slightly larger in terms of funds under management but holding more concentrated portfolios.

An essential part of our analysis is the assignment of a benchmark to each fund in our sample. We do so by using amended modified version of the method proposed by Cremers and Petajisto (2009), where we identify which of 18 different indices[5] most closely matches

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[4] The holdings data for the funds is obtained from Thomson Reuters S12 Mutual Fund Holdings with all other fund data being obtained from the CRSP Survivor-Bias-Free US Mutual Fund Database. The index data is obtained from the Russell Company and Standard and Poors and the returns data from the CRSP and CRSP/Compustat Merged Database. Consistent with other studies in the mutual fund area, we use the funds' strategic objective provided by CRSP to filter our sample. Since CRSP provide several sets of strategic objectives (namely Strategic Insights and Lipper Investment Objectives) and neither set of strategic objectives data covers the entire sample period, we use a combination of Strategic Insights and Lipper Investment Objectives to filter our final sample. We selected funds with the following Lipper Investment objectives: G, GI, LSE, MC, MR and SG. Funds from the Strategic Insights objective codes, we selected AGG, GRI, GRP, ING, SCG and GMC

[5] We collected index compositions data for a total of 18 equity market indexes of which nine belonged to the Russell family (namely the Russell 1000, Russell 2000, and Russell Midcap indexes, plus the value and growth components of each) and the other nine being sourced from Standard and Poors (the S&P400, S&P500 and

the fund's actual portfolio holdings[6]. Each quarter we sort the stocks held by a fund according to their bet size and form portfolios based on these rankings (Top 5, Top 10, and so on) using conviction weights which take account of both the weighting of each stock in the benchmark index and the extent of the manager's preference for each stock[7]. In this way, we calculate the quarterly returns for the Top 5 through to Top 30 portfolios over the 69 quarters in our sample. In turn, these quarterly returns are used to calculate the annualised returns for each of the concentrated portfolio, their standard deviations and their Sharpe ratios (Sharpe, 1966)[8].

Our Findings

We report in Exhibit 1 the annual return, standard deviation and Sharpe ratio for a series of concentrated portfolios with stocks holdings ranging from the most preferred five stocks (Top 5 portfolio) to the most preferred 30 stocks (Top 30 portfolio). In addition we report the returns realised by subsets of these portfolios (i.e. Top 1 to 5 stocks, Top 6 to 10 stocks, and so on). For comparison purposes, we also provide in Exhibit 1, the average performance of the actual portfolios held by the funds (All Funds) and of a portfolio consisting of the benchmarks assigned to each fund (Own Index).

The information contained in Exhibit 1 provides both good and bad news for managers. The good news is that the concentrated portfolios based purely on the managers' stock preferences outperform both the benchmark portfolio and the managers' actual portfolios. This is strong evidence of their stock pickling skills with their most preferred stocks (Top 5) outperforming the benchmark by in excess of 5%pa. The bad news is that the returns realised on the concentrated portfolios consistently decline as the size of their portfolio holdings increase. This is consistent with the ability of managers to identify mispriced stocks declining as they dig deeper into their stock preferences and so bring into question their ability to populate diversified portfolios.

Exhibit 1: Returns, Incremental Returns, Standard Deviations, and Sharpe Ratios
for Concentrated Portfolios

Exhibit 1 reports the total returns, standard deviations and the share ratio of the concentrated portfolios and the contribution to returns of incremental portfolios. Each quarter, we formed the concentrated portfolio by measuring the difference between each fund's portfolio holdings and the holdings of the assigned benchmark index. The differences can be thought of as the outcome of the "Bets" against the benchmark. We sort these differences by size from the largest. The concentrated portfolios Top5 to Top30 comprised of the largest 5 bets to the largest 30 bets respectively. We measured the total returns and standard deviation as of these portfolios as the mean total returns and standard deviations of the funds across time. In the last column, we measured the incremental returns made by each 5 stocks as we move down the managers' choice of stocks. The notations ***, ** and * denotes statistical significance at the 1%, 5% and 10% level respectively.

Portfolios	Total Returns (annualised)	Standard Deviation (annualised)	Sharpe Ratio	Portfolios	Incremental Returns
Top 5	14.35%**	22.3%	0.441	Top 1 to Top 5	14.35%**
Top 10	12.95%**	20.2%	0.422	Top 6 to Top 10	11.10%**
Top 15	12.28%**	19.2%	0.390	Top 11 to Top 15	10.30%**
Top 20	11.78%**	18.3%	0.403	Top 16 to Top 20	9.60%**
Top 25	11.41%**	17.7%	0.397	Top 21 to Top 25	9.19%**
Top 30	11.09%**	17.2%	0.391	Top 26 to Top 30	8.46%**
All Funds	10.83%**	19.5%	0.331	All Funds	10.83%**
Own Index	9.14%**	19.5%	0.246	Own Index	9.14%**

As one would expect, the more concentrated portfolios have higher total risk as measured by the standard deviation of their returns. However, these standard deviations progressively decrease as the number of stocks in the concentrated portfolios increase to a point where the total risk of a concentrated portfolio of 15 stocks equates with those of the portfolios actually held by the managers. Given our findings on returns and standard deviations, it is not surprising that the concentrated portfolios have a higher Sharpe ratio than both the actual fund holdings and the benchmark portfolios. Again, our finding that the Sharpe ratio of the concentrated portfolios consistently declines as we expand the portfolio holdings brings into question the risk-return tradeoffs inherent in widely diversified portfolios.

In order to throw greater light on the extent of the managers' stock picking skills, we broke down the return of the concentrated portfolios to increments of five stocks (Top 1 to 5, Top 6 to 10, and so on). The incremental returns reported in Exhibit 1 highlight the rapid rate of drop off in the realised returns as one proceeds down the list of stocks preferred by the managers. Indeed, the ability of the managers to add value by stock selection is eroded as the managers extend beyond "Top 25" preferred stocks.

The discussion to date raises the conundrum that the managers would appear to have extensive stock picking skills, a finding which seems in conflict with the evidence that suggests that they do not deliver outperformance for their clients (Baumol, 2013)[9]. The resolution of this conundrum might lie in the fact that the median number of stocks included in the portfolios of active US equity mutual funds is 87 stocks whereas at any point in time the average managers is able to identify no more than 25 mispriced stocks. In other words as managers progressively extend the size of their portfolio's, they soon reach a point where they are adding stocks that actually detract from the portfolio's performance relative to its benchmark. This suggests that a point will be reached where the loss of return from the addition of another stock to a portfolio is likely to way any risk-reduction benefits attributable to the addition of that stock.

Introducing Costs

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[9] The evidence in our study would suggest that the average manager outperforms their index by about 1.7%pa. This is almost totally negated by the average expense ratio over the sample period of 1.5%pa (Investment Company Institute, 2014)

One important caveat to the above discussions is that the returns on the concentrated portfolios (and the Index) are before transaction costs while the actual returns of the funds (All Funds) are after transaction costs. In order to incorporate costs into the analysis, we first estimate the cost of transacting individual securities using the y-split method proposed by Goyenko et al. (2009). We then use these costs in combination with the actual portfolio turnover figures to estimate the transaction costs for each of the portfolios[10]. In Exhibit 2, we report the annual transaction costs for the various strategies, including investing in the benchmarks, and also the net (after-transaction costs) annual returns for each strategy. There is no transaction costs deducted from the "All Funds", as they are already reflected in the returns.

Exhibit 2: After-Cost Returns and Incremental Returns of Concentrated Portfolios

Exhibit 2 reports the annualised (gross) returns and net returns of the concentrated portfolios and the incremental portfolios. The incremental returns are the annualised gross and net-transaction cost returns made by each 5 stocks as we move down the managers' choice of stocks. We measured the quarterly returns for each of the portfolio strategies and used these returns to calculate an annualised return. Net annualised returns are calculated as the gross returns of the portfolios net of transaction costs. Transaction costs are estimated using the y-split method proposed by Goyenko et al. (2009) which calculate the effective costs of trading individual using daily closing prices. The last two rows of the table reports the performance of the fund and the matching index as mean of comparison to the returns of the concentrated portfolio. The notations ***, ** and * denote statistical significance at the 1%, 5% and 10% levels respectively.

Portfolios	Annualised Returns	Transaction Costs	Annualised Net Returns	Incremental Portfolios	Annualised Returns	Transaction Costs	Annualised Net Returns
Top 5	14.35%**	1.60%	12.75%**	Top 1 to 5	14.35%**	1.60%	12.75%**
Top 10	12.95%**	1.45%	11.50%**	Top 6 to 10	11.10%**	1.25%	9.85%**
Top 15	12.28%**	1.35%	10.93%**	Top 11 to 15	10.30%**	1.04%	9.26%*
Top 20	11.78%**	1.28%	10.50%**	Top 16 to 20	9.60%**	0.98%	8.62%*
Top 25	11.41%**	1.24%	10.17%**	Top 21 to 25	9.19%**	0.94%	8.25%
Top 30	11.09%**	1.18%	9.91%*	Top 26 to 30	8.46%**	0.80%	7.66%
All Funds	10.83%**	n.a.	10.83%	All Funds	10.83%**	n.a.	10.83%
Own Index	9.14%**	0.20%	8.94%	Own Index	9.14%**	0.20%	8.94%

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[10] The y-split method is an extended version of the method first proposed by Lesmond et al.(1999)

The transaction costs associated with the concentrated portfolios prove to be quite large and account for a significant portion of the added-value attributable the managers' stock selection skills. It is the incremental returns after-transactions costs reported in the far right-hand column of Exhibit 2 that are the most insightful in that they suggest that at any point of time, the average manager is only able to identify slightly in excess of 15 mispriced stocks once account is taken of the costs of implementing the investments. Indeed on an equally weighted basis, the addition of the 26th to 30th preferred stocks to the portfolio will reduce the (excess) return of the portfolio by 20 basis points and this impost on returns will further increase as the portfolio is extended beyond 30 stocks. Given that previous studies have identified that the diversification benefits have largely been eroded by the time that the time that portfolios size has reached 30, it becomes difficult to justify portfolio holdings of 87 stocks by the typical manager.

Splitting Up the sample

We divide the sample by fund characteristics in order to investigate the extent to which the findings reported for the whole sample of funds hold for important sub-sets of our sample: specifically, we look at fund style, fund size, fund capitalisation focus, fund fees, and client focus.[11]

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[11] The detailed results of our analysis are not reported but are available on request from the authors.

<u>Growth versus value</u>

We have observed previously that there are many more growth funds in our sample than there are value funds. When we split the sample along these lines[12], we find a significant difference between the stock selection skills of growth and value managers. For example, the outperformance of the Top 5 stocks of the growth managers is almost three times greater than that of the value managers. Further, it proves that at any point in time the typical value manager is able to identify less than 15 mispriced stocks while the equivalent figure for growth managers is approaching 30 stocks[13]. With regard to fund characteristics, both value and growth managers are true to their style in terms of the stocks that they hold with both also having a bias towards strong momentum stocks. Other points of differentiation are that the growth managers run much higher market risk in their portfolios while the value managers have a slightly greater tilt towards small cap stocks.

<u>Small and large</u>

We rank the funds by assets under management and designate the top tercile as large funds and the bottom tercile as small funds. Again we find that it is the more concentrated managers of both the large and small managers that perform best and again the performance of both erodes as the size of their portfolios increase. However it is the larger funds that produce the best outcome with their added value being about 25% higher than that of the smaller funds. This is an interesting result as it

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[12] This division is done on the basis of the fund's benchmark (e.g. a fund with a growth benchmark is considered a growth fund, and so on).

[13] The superior stock selection skills of the growth managers is at least partially explained by the fact that by construction, the growth indices are biased towards expensive stocks

suggests that the funds that become large on average are under the control of managers with superior stock picking skills. There is little to differentiate between the characteristics of the small and large funds with both running portfolios that have slightly above average market risk, and with tilts towards growth and strong momentum stocks.

Small cap versus large cap

We separated the funds into small cap and large cap funds on the basis of the benchmark assigned to each fund. Judged on the performance of the most preferred stocks (Top 5), the small cap managers are slightly superior to the large cap managers. However, the ability of the small cap managers to identify mispriced stocks is limited to their 10 most preferred stocks while for the large cap managers it extends down to their 30 most preferred stocks. Further, the volatility of the concentrated large cap portfolios is distinctly lower than that for the concentrated small cap portfolios.

High and low fees

We ranked the funds by fees and then assigned the top tercile to the "high fee" group and the bottom tercile to the "low fee" group. The medium fee of the high fee group was 2.05% while that of the low fee group was 0.80%. The higher fees were easily accounted for by the difference in annualised returns of the Top 5 portfolio of the high fee funds being 1.8% higher than that achieved by the low fee funds. However, this difference reduces to 1.4% for portfolios composed of stocks ranked six to 10 and falls to less than 1% for portfolios composed of stocks ranked 11 to 15. Hence the high fee funds do appear to have superior stock selection skills but on an after-fee

basis this only translates to higher returns for clients across their 10 most preferred stocks. When we compare the fund characteristics of the portfolios held by the high fee and low fee funds, we find that they are all tilted towards small, high momentum value stocks with the high fee funds having the greatest small and value tilts while the portfolios of the low fee funds are more driven by momentum.

Retail versus institutional

The final split is between funds geared towards the retail and institutional investors with our sample having about twice as many retail funds as compared with wholesale funds. Again the added value of each type of fund is greatest for the more concentrated portfolios with the added value generated by the two types of funds being almost identical as are all of their other portfolio characteristics. These results are consistent with previous analysis that has also found no significant difference between the performance of retail and institutional mutual funds (Salganik, 2011).

Worst Portfolios and Best/Worst Portfolios

The analysis to date has concentrated on evaluating the performance of long-only concentrated portfolios based on the most preferred stocks of the managers and suggests that they are skilled at identifying a limited number of underpriced stocks. This raises the obvious question as to the extent of the managers' talents in identifying the stocks that are going to perform poorly in the future. We explore this possibility using exactly the same methodology as before where we now use the lowest ranked (negative) active positions of the managers to determine the stocks that they dislike most. The "Bottom 5" portfolio for each fund each quarter is made up the five lowest ranking stocks, the "bottom 10" portfolio is made up of the 10 lowest ranking stocks, and so on. The portfolio weights assigned to each stock is based on the convictions weights as previously described.

We find that a short position in their five most disliked stocks outperforms their benchmark by 4.7%pa after taking account of transactions costs. However, what is even more impressive is that a short position in their 30 most disliked stocks still underperforms their benchmark by 2.3%pa. These findings suggest that managers are even better in identifying expensive stocks than they have proved to be in identifying cheap stocks.

The findings reported to date logically raise the question as to the potential of concentrated long/short portfolios based on the stock preferences of the fund managers. Not surprisingly, we find that this strategy if implementable would perform particularly well with the Best/Worst 5 combination on an after-transaction

costs basis returning 8.5%p.a. This outperformance does taper off fairly rapidly to a point that it is reduced to 4.86%p.a. for the Best/Worst 20 portfolio. However, it has to be remembered that these returns are earned on effectively a zero investment and compare favourably with the average risk free rate over the sample period of 4.34%p.a.

Implementable Strategy

The findings to date question whether it is a good practice for an investor to seek the benefits of diversification by investing in funds that hold widely diversified portfolios. An obvious alternative being for the investor to gain access to a manager's most favoured stocks by either investing in a concentrated portfolio offered by the manager or by acquiring a list of favoured stocks from the manager on a regular basis. Either of these options would offer the opportunity for the investor to undertake self-diversification by spreading his investments across concentrated portfolios/preferred stocks sourced from several managers rather than have one or more managers do the diversification for them.

In order to test the performance of such a self-diversification strategy, we first separated all funds into one of nine categories based on both their style (growth, value and style neutral) and the capitalisation of the stocks in which they invest (small cap, medium cap and large cap). We then randomly chose one fund from each of the nine categories and then hold the investment in that fund for a period of three years. The after-costs returns reported in Exhibit 3 were obtained by replicating each of the strategies through 1,000 iterations. For example, where the strategy is to randomly

choose one manager from each of the nine categories and then invest the funds in a portfolio consisting of each manager's top 5 stocks, we obtain a return of 12.92%pa with a standard deviation of 23.74%. This performance is over 2% higher than the return from a strategy of randomly choosing a (or five) managers and investing in their diversified portfolios. This higher return does come at the expense of higher volatility which is somewhat negated by forming self-diversified portfolio based on the preferred stocks sourced by choosing five managers from each of the nine categories. Consistent with our previous finding that the typical managers stock picking skills are limited to a relatively small number of stocks, we find that the advantages of a self-diversification strategy largely disappear by the time that they are based on the 15 stocks most preferred by the managers.

Exhibit 3: Self Diversification: Returns from Implementable Investment Strategies

Exhibit 3 reports the results of a strategy based on investing in a diversified portfolio of concentrated funds versus a strategy of investing in a less diversified portfolio of concentrated fund. We initially divide the funds into nine groups based on their style (growth, value and style-neutral) and market capitalisation (large cap, medium cap and small cap). The diversified portfolio of concentrated funds is created at the beginning of each three year by a random choice of one (or five) fund from each group with the return for that year being the average of the returns realised by the nine concentrated funds (45 where five managers are chosen). This strategy is simulated 1,000 times as explained above for the diversified strategy and so an annualised return is determined that is typical of that to be realised from following this strategy. Two separate strategies were simulated following the same procedures outlined above: (i) one manager is randomly chosen each period and (ii) five managers are randomly chosen each period; We report the total returns, standard deviation (Std Dev) and the Sharpe Ratio of all of these strategies in the table below. The notations ***, ** and * denotes statistical significance at the 1%, 5% and 10% level respectively.

		Rebalancing every three years		
	Concentrated Portfolios	Returns	Std Dev	Sharpe Ratio
1 Fund of Each Type (i.e. 9 in total)	*Top 5*	12.92%***	0.2374	0.356
	Top15	11.19%***	0.2001	0.339
	Top 25	10.02%***	0.1759	0.321
5 Funds of Each Type (i.e. 45 in total)	*Top 5*	12.91%***	0.2260	0.374
	Top15	11.25%***	0.1962	0.348
	Top 25	10.06%***	0.1735	0.328
Any 1 Fund		10.82%***	0.1943	0.329
Any 5 Fund		10.81%***	0.1939	0.331

We observe that the improvements in the Shape ratio associated with implementing a self-diversification strategy are quite modest. However, this should come as no surprise because one has to remember that the results were generated by a process of randomly selection from all the funds included in our sample resulting in our findings reflecting the skills of the average manager. One observation that we can make is that the stock-picking skills of the renowned concentrators, such as Buffett and Keynes, could hardly be described as average. In order to gain a better insights into the importance of manager skill for the returns realised from concentrated strategies, we examined the performance of the preferred stocks of the better performing managers To do this we ranked the fund's on the basis of their returns relative to their benchmark and then repeated our analysis to calculate the performance of concentrated portfolios if restricted to the top 75% performing funds, the top 50% performing funds, the top 25% performing funds, and the top 10% performing funds with the results of our analysis being reported in Exhibit 4.

It will come as no surprise that the better managers are best placed to identify mispriced stocks, with our interest being in the extent and number of mispriced stocks that the better managers are able to identify. Starting with the best of the best (Top 10%), their five most favoured stocks outperform the benchmark by almost 10%pa and perhaps more importantly, they can identify something like 40 underpriced stocks at any point in time. This suggests that these managers would be well placed to run diversified portfolios but would you want them to? Two reasons for why you might

think NO is (i) there is a fairly rapid decline in the performance of their preferred stocks which reduces to a 2%pa by the time you venture to their "Top 16 to Top 20" stocks, (ii) still half of their portfolio would consist of underperforming stocks if they held the median 87 stocks in their diversified portfolio. A better alternative might be is to combine the very best bets of the best managers with some exposure to an index investment in order to control for risk.

Exhibit 4: Stock Selection Skills by Superior Managers

Exhibit 4 reports the net returns of the whole and various subsamples of concentrated portfolios. Each quarter, we formed the concentrated portfolio by measuring the difference between each fund's portfolio holdings and the holdings of the assigned benchmark index. These differences are the stocks that the managers have the greatest confidence in yielding superior returns. We sort these differences by portfolio weighting from the largest. The concentrated portfolios Top5 to Top30 comprised of the largest 5 bets to the largest 30 bets respectively. We present the net returns of the concentrated portfolio (in Panel A) and the contribution made by the incremental portfolios in the Panel B below. We divide the funds into subsamples on the basis of fund performance. We present subsamples of the top 75, top 50, top 25 and top 10 percentiles. The notations ***, ** and * denote statistical significance at the 1%, 5% and 10% levels respectively.

Panel A: Conviction Weighted Portfolios									
	Returns after Transaction Costs (annualised)					Sharpe Ratio			
Portfolios	Whole sample	Top75%	Top 50%	Top 25%	Top 10%	Whole sample	Top75%	Top 50%	Top 25%	Top 10%
Top 5	12.75%**	13.49%**	14.26%**	16.49%**	18.61%**	0.367	0.395	0.403	0.429	0.445
Top 10	11.50%**	12.20%**	12.86%***	14.67%**	16.56%**	0.350	0.376	0.39	0.408	0.426
Top 15	10.93%**	11.57%**	12.16%**	13.75%**	15.53%**	0.319	0.346	0.36	0.379	0.402
Top 20	10.50%**	11.07%**	11.62%***	13.13%**	14.67%**	0.333	0.358	0.372	0.391	0.406
Top 25	10.17%**	10.73%***	11.22%***	12.69%**	14.13%**	0.328	0.353	0.366	0.387	0.403
Top 30	9.91%**	10.40%***	10.86%***	12.27%**	13.63%**	0.322	0.346	0.358	0.381	0.397
Own Index	8.94%**	8.98%**	8.92%**	8.89%**	8.94%**	0.238	0.240	0.235	0.224	0.238

	Panel B: Conviction Weighted Portfolios				
Incremental Portfolio	Whole sample	Top 75%	Top 50%	Top 25%	Top10
Top 1 to Top 5	12.75%**	13.49%	14.26%**	16.49%**	18.61%**
Top 6 to Top 10	9.85%**	10.41%	10.92%**	12.16%**	13.73%**
Top 11 to Top 15	9.26%**	9.68%	10.05%**	10.97%**	12.42%**
Top 16 to Top 20	8.62%**	8.92%	9.30%**	10.47%**	10.97%**
Top 21 to Top 25	8.25%*	8.38%	8.48%**	9.64%**	10.40%**
Top 26 to Top 30	7.66%*	8.18%	8.20%*	9.15%**	9.93%**

Copycat fund

All of our analysis for both the concentrated and diversified portfolios has been undertaken on a before-fees basis. Therefore, if each manager charged the same fee for running a concentrated portfolio that they do for running a diversified portfolio then the relative advantages offered by the concentrated portfolios would remain unaffected. However it may be that managers would want to charge a higher fee for solely giving away their best ideas and this may negate most of the advantages of investing in the managers concentrated portfolios or undertaking self-diversification based on the stock preferences purchased from the managers.

An alternative available to investors is to avoid paying the managers at all for their preferred stocks but rather obtaining them in the same way we have determined them in this paper using their portfolio holdings once they are made available. Funds are required to release their quarterly holdings two months after the end of each quarter[14] and these holdings become available in an electronic form within one month of their mandatory release. In order to investigate the possibility of the investors "copy catting" the managers and implementing a strategy based upon the managers' best bets but with a lag of both two months and three months.

We find that if an investor used the information contained in the holdings immediately that it becomes available (after two months), then an even better performance would be realised than if it was acted upon immediately at the end of the quarter to which the information relates. Indeed, the return of the Top 5 portfolio increases by almost 4%pa and there is a slower drop off in the returns as the portfolios

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[14] Since October 2004, SEC regulation required professional investment managers to report their portfolio holdings on a quarterly basis. Managers are required to report their holdings within 60 days (or 2 months) of the end of the quarter.

are expanded to include lesser preferred stocks. This finding suggests that one could profitably employ a copycat strategy and so implement a self-diversification strategy without paying any fees to the managers[15]. This finding also raises the possibility that managers are too eager in acquiring their preferred stocks and could benefit from delaying their own purchases. It is somewhat surprising to find if one waited for three months until the holding information became available in electronic form, the returns are much reduced and the correlation between the ranking of the preferences and the performance of the stocks are significantly eroded.

Summary Conclusion

There are two important steps in the investment process: ranking the stocks in your investment universe (stock selection) and then combining them to form an investment portfolio (portfolio construction). The realised return on the portfolio obviously reflects the joint impact on these two decisions. We have attempted in this study to separate the impact of these two steps by calculating the returns that a manager would have realised if he had restricted his investments to concentrated portfolios composed of the manager's most preferred stocks (and also weighted on the basis of these preferences). We found in a large sample of US equity mutual funds that the managers would have improved their performance and comfortably outperformed their benchmark by going down the concentrated portfolio route.

Undoubtedly diversification makes a major contribution to minimising the risk inherent in an investment portfolio. Further with efficient markets, there is no return

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[15] Of course the profitability of this strategy would be significantly eroded if it was followed by a large number of investors.

implication from pursuing the benefits of diversification. What this paper highlights is that the same cannot be said when markets are inefficient as now there can be a penalty from acquiring stocks that underperform in the pursuit of risk-reduction. Further we have seen that the typical manager at any point in time can only identify a relatively small number of mispriced stocks and certainly nowhere near as many as they typically include in their diversified portfolios. By acquiring these stocks they dilute the returns realised on their portfolios which perhaps is a major reason why they have not been found capable of adding value for their clients.

The question then is what implication can we draw from our findings? The first is that the much maligned managers of US equity mutual funds who have consistently been found to not deliver for their clients would seem to be fairly competent with stock selection. If managers are able to add value due to their stock selection skills, then this implies that they must consistently be able to identify mispriced stocks which further brings into question the efficiency of the US equities markets. The third major implication for investors is that there may be better ways to achieve diversification than handing their funds over to diversified managers. Indeed, better returns are likely to be achieved by investors splitting their funds over several managers running concentrated investment portfolios. As always, the benefits of this strategy are very much dependent on the ability of the investor to identify the better managers.

We will leave the last word on the subject of diversification versus concentration to Warren Buffett who gave the following advice in his 1993 letter to shareholders:

"Diversification is a protection against ignorance. It makes very little sense for those who know what they're doing."

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