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Manager characteristics: Predicting fund performance

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ABSTRACT

A great deal of research effort has sought to understand whether fund managers have skill. However, most of this research draws inferences from fund returns attributable to funds that may have been managed by many different managers over the years. In this paper we focus on the fund manager. We put together a comprehensive data base of manager returns, including a time series of managers' *career* returns, concatenating performance from the different funds that a manager may have managed over time. We relate these returns to the characteristics of the managers as we seek to understand whether these characteristics have an impact on: manager skill; manager style; and on performance persistence.

1. Introduction

Mutual fund performance has attracted an enormous amount of attention in the academic literature in recent decades with publications numbering the thousands (see, inter alia, Cuthbertson, Nitzsche, and O'Sullivan (2010) for a comprehensive survey). In this research the focus has been on the history of mutual *fund* returns. Mutual funds are managed either by individual managers or by a team of managers. Due to the (significant) turnover in managers moving between funds throughout their careers, a fund's return history will often have been generated by several different managers or management teams. Similarly, a manager's career return history will often be comprised of several different funds. However, the vast majority of results relating to the performance of mutual funds treats fund performance and manager performance as being largely synonymous. This prompts the question then as to whether superior performance, where it exists, resides at the level of the fund organisation or with the fund manager(s). A case can be made for both. There may be relevant cross-sectional differences across fund organisations, for example, in terms of resources such as IT resources, research analysts, marketing, economies of scale, etc. Alternatively, cross-sectional differences in manager characteristics may be relevant to performance such as age, experience, education, gender, etc. and this has much supporting evidence in the behavioural finance literature (see, inter alia, Cuthbertson, Nitzsche, and O'Sullivan (2016)).

In the financial media, mutual funds are regularly advertised on the basis of (recent) performance history while 'star' managers are also regularly profiled. Both attract significant attention among both institutional and retail investors and inform investment decisions accordingly. Investors need to be able to attribute performance between the two so that they can make informed investment decisions.

As described, the extant literature largely focuses on fund return histories. In this paper we contribute to a much smaller but growing literature that focusses on manager return histories. Specifically, we investigate the relationship between manager characteristics and (i) manager performance and (ii) manager styles, behavior and risk taking.

First, we examine the relationship between manager characteristics and manager performance. To this end we collected information on individual managers: age, industry experience, fund tenure, educational attainment, gender, level of team involvement and ownership (stake in the fund). These manager characteristics capture indicators of ability, skill, knowledge, effort, motivation, social and professional networks and 'skin in the game' etc., that may play a major role in a manager's performance and results. For example, performance differences across managers could be attributed to ability associated with degree type, educational institution attended or to professional qualifications. Alternatively, that performance may be related to behavioural differences in turn related to a manager's age, experience in the industry, tenure with the fund, investment in their own fund, gender or to the team size. Do more experienced managers benefit from having spent more time in the industry? Do older managers benefit from greater wisdom? Do younger managers work harder to establish theirs career or to avoid being fired? Does a personal investment in the fund affect

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motivation and hence performance? It is easy to imagine how these manager characteristics could influence performance.

Second, it has been established that manager performance can be partly attributed to risk-taking and investment styles (see, inter alia, Daniel, Grinblatt, Titman, and Wermers (1997)). It is therefore possible that differences in risk-taking and investment style are influenced by the characteristics of a manager. For example, it may be that greater education attainment and/or professional qualifications engenders greater confidence among managers to deviate from the pack so that they are willing to bear greater market risk or idiosyncratic risk or, conversely, that similar educational backgrounds lead to professional or informal social networks that lead to similar trading and herding. Does ownership in the fund lead to more conservative risk taking? Do individual managers make more conservative decisions while teams make more extreme trades because of a sense of diminished responsibility among individual team members? We aim to shed light on the relationship between investment style and the characteristics of fund managers. Our paper focuses for the most part on investigating, after controlling for behavioural differences, whether manager characteristics continue to explain risk and style *adjusted* performance.

Our study contributes to the literature by examining a large sample of over six-thousand unique US equity mutual fund managers. Because a manager may manage more than one fund, our total sample size is over sixteen-thousand time series of *manager-fund* returns. To our knowledge we present the first research that tracks managers as they switch between funds over their career. We concatenate these returns from different funds into a manager career history. By doing this we create over six-thousand time series or histories of *manager-career* returns. In addition, again to our knowledge, this is the first study to carry out a detailed analysis of performance *persistence* at manager rather than at fund level. This includes a persistence analysis by eleven manager characteristics and includes an examination of the interactions between these characteristics to shed light on the true underlying drivers of *manager* performance persistence. By examining performance and performance persistence among both manager-career returns and manager-fund returns, our study helps provide insight into whether performance and persistence are attributable to managers or funds. We consider a long history between January 1990 to July 2015. This period includes several periods of significant disruption and resulting volatility in financial markets and therefore captures the role of manager characteristics in responding to market extremes.

The most consistent result from our estimates of the cross-sectional relationship between manager characteristics and manager skill, proxied by the alpha generated from a Carhart four-factor model, are that accumulated wisdom, however this is proxied, has a positive relationship with manager skill: the longer the manager's tenure, the more experienced the manager is and the older the manager, the better the performance, other things equal. When we consider the relationship between these same characteristics and each manager's exposure to the four risk factors in the Carhart model, among other interesting results we find more experienced fund managers tend to run portfolios that have: lower exposure to the market, size and momentum risk factors; higher exposure to the Value risk factor; and no significant exposure to idiosyncratic risks. We also find that when a manager has a stake in a fund they tend to have a lower exposure to all of these risk factors relative to managers without a stake in their fund. To our knowledge we are also the first to look at the relationship between manager characteristics and performance persistence. Our main findings here are that performance persistence is most evident among male managers, non-CFA managers, 'quant' managers, high SAT score managers, long experience and managers that have managed their fund for a long period of time. We also find evidence to suggest, however, that long experience over short experience is a particularly important characteristic and explains much of the findings on persistence around gender and the CFA designation.

The rest of this paper is organised as follows. In section 2 we review the related literature; in section 3 we outline our methodology; in section 4 we present our cross-sectional and our performance persistence results; section 5 concludes the paper.

2. Related literature

Compared with the fund performance literature, the manager performance literature is relatively small. An early paper that focusses on the manager rather than on the fund is that of Chevalier and Ellison (1999a). The authors study a set of 492 managers who had sole responsibility for a growth or an income mutual fund for at least some part of the sample period from 1988 to 1995. The researchers identify four manager characteristics: manager age; whether the manager has an MBA; the manager's tenure with the fund; and the SAT score of the manager's undergraduate *alma mater*. Initial results based on each manager's raw return in excess of the market return indicated that younger managers, managers with an MBA and for managers that graduated from a higher SAT score institution contributed to superior performance. However, the paper also reveals some significant behavioural differences across managers. For example, MBA holders and manager with higher SAT scores are more likely to manage higher beta funds while managers with longer tenure tend to manage lower beta funds. Similarly, MBAs have a higher propensity to hold value stocks while older managers tend to pursue momentum strategies. Chevalier and Ellison (1999b) find that younger managers, concerned about establishing a successful fund management career, tend to manage portfolios with less unsystematic risk and have more "conventional portfolios". On controlling for these behavioural (ie, risk) differences, Chevalier and Ellison (1999a) find that some performance differences remain, however. In particular, managers who attended higher SAT score institutions delivered higher risk-adjusted returns.

Other studies have also focussed on indicators of education, proxied by qualifications as well as the source of the qualification, to see whether these markers have any impact upon fund performance and other fund features. Using a sample of 518 funds that have a single, named fund manager over the short sample period of 2000–2003, Gottesman and Morey (2006) look at an array of manager education statistics. They find a positive relationship between manager performance and the average mean GMAT score from the institution where a manager received their MBA qualification. However, they also find that other education/qualification variables, such as a CFA designation or a PhD are generally unrelated to performance.

The manager's gender and its possible role in risk taking and performance is perhaps of more common or universal interest. The evidence is fairly mixed. Bliss and Potter (2002) find that female managers of both US and international equity mutual funds tended to produce higher raw returns than their male colleagues. Atkinson, Baird, and Frye (2003) investigate the performance of 144 fixed-income mutual funds across nine investment categories. They find that a fund manager's gender does not lead to significant differences in terms of fund performance, fund risk or other fund features. Barber and Odean (2000) find that the female managers in their sample tended to trade less than their male counterparts and at the same time produce a better risk-adjusted performance. The authors put this down to the psychological trait of "overconfidence", that is, men, particularly single men, tended to trade more because they were more confident (overconfident) than female traders. Finally, using Taiwanese fund data, over quite short period, Hu, Hsueh, and Wang (2012) also find that female fund managers produce superior risk-adjusted returns than their male counterparts possibly indicating that this finding persists across cultural and international differences.

Although comparatively small, the manager characteristic literature reports a strong role for manager fund industry experience, tenure (length of time with a particular fund) and age more generally in manage performance. Using an albeit survivorship-biased sample of mutual fund returns taken from the 1991 Mutual Fund Sourcebook, Golec (1996) finds that the most significant predictor of performance is manager tenure while Ding and Wermers (2012) analyse the performance of over 2500 domestic US equity funds and conclude that more experienced fund managers have superior skill to less experienced managers. Using a more recent sample period, Clare (2017) studies the performance of 357 long-serving managers, and also reports that managers with greater experience and fund tenure produce average returns in excess of those produced by the wider population of managers. However, on further investigation, over the ten-year period there is no evidence of performance persistence. Indeed, the relative performance of these long-serving fund managers actually declines over the ten-year period, so that by the end of the sample the experienced managers are underperforming the wider market. One interpretation of this is that these managers may have "got lucky" early on in their careers and gradually took fewer off-benchmark positions in subsequent years to preserve their careers. Another explanation is that their fund management skills declined with age.

In a departure from earlier findings, in his more recent study and sample, Clare (2017) finds that female fund managers produce lower benchmark-adjusted returns than their male counterparts, a difference that was found to be statistically significant. Also somewhat different from earlier results, Clare (2017) also looks at the manager education/performance relation in a sample of long-serving managers and finds no significant relationship between the two - instead finding more significant relationships between fund features such as the average number of holdings in the fund and the fund's fee level.

In our comprehensive study we collect gender, educational, age/experience, ownership and team size-related characteristic information on a particularly large set of 6291 fund managers over a longer sample period of twenty-five years. We believe this to be a significantly larger data set than previous earlier studies. To our knowledge we are also the first study to carry out a detailed examination of performance persistence at manager level.

3. Data

Our mutual fund manager returns and characteristics data are sourced from Morningstar. We extract the oldest share class of US equity funds including non-surviving funds. Fund returns are monthly in frequency between January 1990 to July 2015. Fund returns are net of management fees.

Morningstar typically categorises the time series of historic returns data by mutual *fund*. However, Morningstar includes several additional data fields. One is *manager* history. Here, for each fund, the database records the start and end date of each manager of a fund as well as the managers' names over time. In many cases a fund is managed by a team of managers at the same time. Similarly, many managers manage more than one fund at the same time. With some data processing it is possible to reformat the historical returns by each *manager* name over time. In so doing, our dataset contains 16,207 manager histories where a given manager may appear more than once in the sample if they are either managing more than one fund at the same time or if they have managed several different funds over their career. We denote these 16,207 cases as '*manager-funds*'.

We also create a single time series of returns for *each unique* manager over their career. Here, for each month in our sample, we calculate each manager's average return across the funds that s/he manages that month. We concatenate these returns into a single time-series of returns that each manager earned as they switched between different funds over their careers. We denote these as the '*manager-career*' returns. Our data set contains 6291 unique 'manager-career' returns.[1]

Morningstar also includes a field that contains manager biographies. This is a text field that typically includes information about the manager's education (degrees attained), institution attended, year of graduation, professional qualifications and career start date. From the manager bio field we extract their undergraduate degree. For this study, we hypothesise that two types of undergraduate degree may be particularly relevant to manager performance, namely whether the manager has a (i) business subject degree or (ii) a quantitative subject degree. Exercising some judgement and discretion, our 'business degrees' include economics, accounting, finance, general business degrees and variants of same. Our 'quantitative degrees' include mathematics, statistics, physics, engineering and variants of same. We create a cross-sectional (across managers) zero-one dummy variable for each degree type. Also, from the manager bio we extract information about whether the manager has: (i) an MBA, (ii) a doctorate or (iii) the CFA designation. Again, we create a zero-one dummy variable in each case. These variables are an attempt to capture the manager's ability and/or professional associations and networks that may inform some of the manager's trading decisions or investment style. As the manager bio field indicates the manager's *alma* mater, we construct a variable to represent the institution's SAT score. Following Chevalier and Ellison (1999a) we construct a composite SAT score for each school by summing the average of the upper and lower bounds of both the Verbal SAT score and the Math SAT score. Although imperfect, we use the institutional SAT score as an estimate of the manager's natural ability, quality of education and, again, social or professional networks. Finally, from the manager bio field we extract the manager's gender. This is done by identifying subject pronouns (he, she) and possessive adjectives (his, her) etc. in the text. In around 100 cases, it was necessary to perform a manual, internet-based search of the fund's website or to use other internet sites such as LinkedIn to identify the manager's gender. From this information we create a one/zero, male/female dummy variable.

As mentioned, the manager bio field includes the manager's year of graduation. Consistent with the work of Chevalier and Ellison (1999a), we estimate manager age by assuming that each manager was 21 years old upon graduating from college. For a given manager of a given fund, the age measure for that manager-fund is calculated as the difference between the year of graduation and the last time period the manager managed *that* fund. Therefore, if a manager managed several different funds over their career, the age observation will differ for each manager-fund. Similarly, for a given manager of a given fund, the mutual fund industry experience measure for that manager-fund is calculated as the difference between the time period the manager first appears in our sample and the last time period the manager managed *that* fund. We calculate the manager's tenure with a particular fund as the difference between the manager's first and last time period observations with *that* fund. We measure experience and tenure in months.

Morningstar also includes an "ownership" field. This indicates the size of the manager's personal investment in the fund, if any. We wish to investigate the relevance of this variable in manager performance because it may affect the manager's motivation. Unfortunately, the level of the manager's personal investment is not available historically on a monthly basis. For the purposes of our analysis, we simply create a dummy variable indicating whether a manager had a personal stake in the fund or not. In our sample of manager-funds, 41% of managers had a personal stake in the fund.

Our final characteristic is 'team size'. In our sample, the majority of funds are managed by a team of managers rather than by a single manager. Team size (the number of team members) may vary over time as individual team members depart or join the fund. We calculate team size as a weighted average of the number of team members, weighted by the proportion of months that it is managed by each number of team members. For example, suppose Manager A managed a fund over for one hundred months and that during the last ten of the months they were joined by Manager B. The team size value for Manager A is $1.1 = 1(90/100) + 2(10/100)$. The characteristic variables are summarised in Table 1. In our sample of manager-funds, the cross-sectional average team size is 5.8 with a standard deviation of 4.7. The lowest (highest) team size reported by funds is 1(29).

[1] In these figures we have removed managers with fewer than 30 return observations for more reliable statistical inference in the analysis that follows.

Table 1
Characteristics variables.

Variable	Description
Gender	1 if the manager is male; 0 otherwise
CFA	1 if the manager is a CFA Charter holder; 0 otherwise
Doctorate	1 if the manager holds a doctoral degree; 0 otherwise.
MBA	1 if the manager has an MBA; 0 otherwise
SAT	A score ranging from 826 to 1535 according to the SAT score of the manager's *alma mater*.
BUS UG	1 if the manager has completed a business-related undergraduate programme; 0 otherwise
QUANT	1 if the manager completed a quantitative degree programme (e.g. maths, CS, engineering, etc); 0 otherwise
Tenure	Length of time in months that a manger has managed a given fund.
Experience	Length of time in months since a manager first appears as a fund manager in our sample.
Age	Length of time in year since a manager's year of graduation.
Owner	1 if the manager has a personal investment in the fund; 0 otherwise
Team Size	Weighted average number of managers of a fund, weighted by length of time managers are team members.

From the manager bios (see examples in Appendix 1) we extracted a range of manager characteristics. These characteristics are shown in column 1. In column 2, we describe the characteristics as entered in the regression analysis.

We use the returns series described above to estimate the alphas and beta exposures using the Carhart (1997) four-factor performance model. We describe the use of this model in Section 3.

In Table 2, we present some simple descriptive statistics of the manager characteristics.

Binary variables are shown as the percentage of the managers with the characteristics. For example, 89.1% of the managers are male, 44.5% of manages have the CFA designation, while 74.6% have undergraduate degrees in business-related subjects. For the remaining variables, the table reports the cross-sectional average and standard deviation as well as the minimum and maximum sample values. Experience and tenure are measured in months while age is measured in years (data here relate to set of managers prior to the imposition of a minimum 30 observation restriction in the estimation results that follow). The average manager age is 46 years while the oldest manager is 69 years old. Average experience and tenure are 81 months and 62 months respectively while the maximum is 621 months (51 years) in each case.

4. Method

Our purpose is to investigate the relationship between the characteristics and background of a fund manager and the manager's performance as well as the manager's investment "style". To do this we first estimate the manager performance and style/risk measures. For each manager in our sample we estimate the Carhart (1997) four-factor performance model as follows:

$$r_{i,t} = \alpha_i + \beta_{1,i}(r_{m,t}) + \beta_{2,i}(SMB_t) + \beta_{3,i}(HML_t) + \beta_{4,i}(UMD_t) + \varepsilon_{i,t} \quad (1)$$

where $r_{i,\ t}$is the excess return over the risk-free rate of manager *i* at time *t*; $r_{m,\ t}$ is the excess market return over the risk-free rate; SMB, HML and UMD are zero investment factor-mimicking portfolios for size, book-to-market value and momentum risks respectively. Factor data are sourced from the Kenneth R. French data library.[2] The $\beta_{j,\ i}$, j = 1, 2 … 4, are risk factor loadings of manager *i*. Here, α_i represents risk-adjusted performance not attributable to the explanatory risk factors and may be interpreted as a measure of manager skill. Finally, $\varepsilon_{i,\ t}$ is an assumed white noise error term and may be taken to be the element of the fund's performance due to sampling variation, chance or 'luck'.

Having estimated [1] for each manager *i*, we gather $\widehat{\alpha}_i$as well as $\widehat{\beta}_{i,j}$, j = 1, 2 … 4. We also collect $\widehat{\sigma}^2_{\varepsilon,i}$, the variance of the residuals terms as a measure of the idiosyncratic risk taken by manager *i*.

To investigate the relationship between manager performance and manager characteristics, we estimate the following cross-sectional regression across managers:

$$\widehat{\alpha}_i = \gamma_0 + \sum_{k=1}^{12} \gamma_k(x_{i,k}) + \upsilon_i, \quad i = 1, 2..N \quad (2)$$

where $x_{i,\ k}$is characteristic *k* of manager *I*; N is the number of managers; and $\upsilon_i$is a random error term. The signs, values and significance of $\gamma_k$indicate the nature and strength of the relationship between manager performance and the various manager characteristics. We estimate several versions of [2] over alternative sets of *k*.

In a similar vein, in order to investigate the relationship between manager style and risk taking on the one hand and manager characteristics on the other, we perform separate estimations of the following cross-sectional regression (across managers) for each $\widehat{\beta}_{i,j}$, j = 1, 2 … 4 as follows:

$$\widehat{\beta}_{i,j} = \lambda_0 + \sum_{k=1}^{12} \lambda_k(x_{i,k}) + \eta_i, \quad i = 1, 2..N \quad (3)$$

where the values of $\lambda_k$indicate the nature and strength of the relationship between manager style and risk taking and manager characteristics. Finally, we estimate the cross-sectional regression:

$$\widehat{\sigma}^2_{\varepsilon,i} = \delta_0 + \sum_{k=1}^{12} \delta_k(x_{i,k}) + \omega_i, \quad i = 1, 2..N \quad (4)$$

where the values of δ_k indicate the nature of the relationship between manager idiosyncratic risk taking and manager characteristics.

It is interesting to perform the analysis in [1] to [3] for both the set of 16,207 'manager-funds' performance as well as for the set of 6291 'manager-career' performance. In the case of manager-funds, the same manager will enter the analysis more than once with different alphas where they have either managed more than one fund at a time or more than one fund over different times over the sample period. In the case of manager-career performance, each manager enters the analysis once and will have a unique alpha, i.e., a 'career' alpha.

The analysis performed using expression [1] to [4] tells us about the relationship between manager performance and style and manager characteristics. The mutual fund performance literature also looks at performance persistence, that is, the extent to which past performance can be taken as an *ex-ante* indicator of future performance. This is clearly useful information for any investor. In this paper we look at the possible impact of our set of manager characteristics on performance persistence. To our knowledge, we are the first to provide a comprehensive study of manager performance persistence by (eleven) manager characteristics based 6291unique managers, 16,207 manager-funds over a 25-year period.

To examine this issue we apply the well-established persistence testing method of Carhart (1997) and others. Each month, managers are sorted into decile portfolios according to the t-statistic of alpha from [1] estimated over the previous 36 months.[3] Decile 1 (Decile 10) contains the top (bottom) managers with similar sorting in between. We then record each (equally weighted) decile portfolio return over the following month. Deciles are reformed monthly.[4] We then estimate the alpha of each forward-looking decile by estimating [1]. Overall persistence may

[2] Available at: https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

[3] We sort by the t-statistic of alpha for improved statistical inference over this short estimation period and in taking cognizance of the fact that managers have different numbers of return observations.

[4] For robustness, we perform these tests over alternative backward-looking estimation periods and forward-looking holding periods.

Table 2
Manager characteristics descriptive statistics.

	Gender	CFA	PhD	MBA	SAT	BusUG	Quant	Tenure	Exper	Age
Average	89.1%	44.5%	3.9%	40.2%	1325	74.6%	17.3%	62	80.9	46.3
Std	N/A	N/A	N/A	N/A	145.9	N/A	N/A	55	68.7	10
Max	N/A	N/A	N/A	N/A	1535	N/A	N/A	621.5	621.5	69.8
Min	N/A	N/A	N/A	N/A	826	N/A	N/A	0.03	0.03	21.6

Simple descriptive statistics are provided on the manager characteristics. Binary variables are shown as the percentage of the managers with the characteristics, eg, 44.5% of manages have the CFA designation. For the remaining variables, the table reports the cross sectional average and standard deviation as well as the minimum and maximum sample values. Tenure and experience are measured in months while age is measured in years.

be inferred by observing an approximately monotonic decrease in the value of alpha from decile 1 to decile 10. Economic and statistical significance may be inferred from the sign, value and statistical significance of the decile alphas.

As mentioned, we investigate performance persistence over the full sample of funds as well as by each of the eleven manager characteristics in our sample. For example, we test for persistence among the subset of male managers and among the subset of female managers separately. Similarly, we test for persistence among managers with long experience and short experience separately. However, we also consider possible interaction effects between the characteristic. For example, from these separate analyses we may find persistence among male managers over female managers and among more experienced managers over less experienced managers. However, it may be the case that male managers have more experience than female managers in our sample, prompting the question as to whether it is gender or experience that is driving any persistence. To investigate this sort of hypothesis we double-sort our sample by two characteristics into four subgroups and test for persistence in each of the four subgroups. This helps us identify the characteristic that may be driving any observed persistence. In principle, we can also treble-sort the sample by three characteristics. However, we find in many cases that the resulting subset sizes are too small to perform a meaningful persistence analysis, in particular in the earlier part of the sample period.

5. Results

5.1. Cross-sectional test results – manager skill

To determine the relationship between the manager characteristics detailed in Table 1 and manager skill, we estimate expression [2] using different combinations of the characteristics and where the dependent variable and our measure of skill, alpha, has been estimated using the Carhart four-factor model. The results in Table 3 are based upon the 16,207 "manager-funds" sample.[5]

The regression result presented in the first row in Table 3 includes all of the available characteristics variables. The evidence from past literature regarding the role that gender plays in alpha generation is mixed, with some papers finding that it plays a significant role and others finding no relationship between gender and performance. Our result shows that female managers produce a higher alpha than their male counterparts, since the coefficient is negative. However, we do not find this result to be statistically significant. We also include in our regression five indicators of academic achievement, plus a CFA dummy variable that captures whether a manager is CFA chartered or not. We find that being CFA qualified has a positive relationship with manager skill, but that the coefficient fails to reach the 95% confidence level (one-tail) test and is therefore not a statistically significant result at conventional confidence levels. The coefficients on the MBA, SAT and Quantitative undergraduate qualification characteristic variables are all found to have a positive relationship with manager skill, but are not found to be significant. The negative coefficient on the Business Undergraduate variable is also found to be statistically insignificant. However, we do find a significant, negative relationship between the PhD dummy variable and the four-factor alpha. This result indicates that having a PhD detracts performance from a fund. We find that the ownership characteristics variable is positively related to performance, but that this relationship is not statistically different from zero. However, we find that the Team size characteristic variable is negatively related to manager skill and that this result is statistically significant. This implies that the larger the fund management team, other things equal, the poorer the performance. The final set of characteristics variables all capture, in different ways, what we might refer to as manager "wisdom". The results show that the Tenure, Experience and Age characteristics variables all have a positive relationship with fund performance. We find that the coefficient on Tenure is bordering on statistically significant at the [95%] level of confidence, the coefficient on Experience is significant at the 95% level, but that the Age coefficient is found to be statistically insignificant. These three characteristics variables will be correlated to some degree. We therefore re-estimate the regression presented in row 1, including just one of these variables. The results are presented in rows 2, 3 and 4 of the table. First, we should note that the results relating to the other characteristics variables are broadly unchanged. The coefficients on the CFA variable are still positive, but not quite statistically significant, and the coefficients on the PhD variable are all negative and statistically significant, as are the coefficients relating on the Team size variable. In each case (rows 2, 3 and 4) we find the variable designed to capture manager "wisdom" to be positive and highly significant. This finding is generally consistent with past findings (with the main exception being Clare, 2017).

In Table 4 we present results analogous to those presented in Table 3, but where we use the "manager-career" sample instead of the "manager-funds" sample. In row 1 of Table 4, we present regression results that include all available characteristics variables for which we have sufficient observations; in rows 2 to 4 we include either the Tenure, the Experience or the Age variable. The signs on the coefficients of the variables shown in row 1 of the table are consistent with those in row 1 of Table 3. However, we now find that having a CFA designation has a positive and significant impact on alpha, while the statistically significant relationship between having a doctorate and performance found in Table 3 is now found to be insignificant. Most notably, the results relating to Tenure, Experience and Age in Table 4 are very similar to those found in Table 3, both in terms of the coefficient sign and the significance of the relationships. It seems that however we choose to proxy for accumulated wisdom, it has a positive relationship with manager skill: the longer the manager's tenure, the more experienced the manager is and the older the manager, the better the performance, other things equal.

5.2. Cross-sectional test results – manager style/risk exposure

Tables 3 and 4 present the relationship between manager characteristics and manager skill. In Table 5, using the manager-funds sample,

[5] In the regressions in Table 3, and in Table 4 below, some data on some manager characteristics may be unavailable for a small number of managers. Here, in each model estimation, results are based on the managers for which data are available across managers.

Table 3
Manager performance and characteristics (manager-funds).

	Inpt	Gender	CFA	PhD	MBA	SAT	BusUG	Quant	Owner	Team Size	Tenure	Exper	Age
1	−2.189	−0.032	0.281	−1.437	0.305	0.001	−0.253	0.147	0.051	−0.036	0.003	0.003	0.010
	(−2.106)	(−0.110)	(1.574)	(−2.334)	(0.621)	(1.039)	(−1.128)	(0.509)	(0.288)	(−2.144)	(1.651)	(2.215)	(0.931)
2	-1.219	-0.039	0.212	-1.546	0.330	0.000	−0.290	0.153	0.093	−0.029	0.006		
	(−1.428)	(−0.136)	(1.200)	(−2.516)	(0.671)	(0.679)	(−1.295)	(0.529)	(0.528)	(−1.716)	(4.045)		
3	−1.637	−0.040	0.268	−1.465	0.277	0.001	−0.288	0.077	0.068	−0.045		0.005	
	(−1.893)	(−0.138)	(1.507)	(−2.392)	(0.566)	(1.077)	(−1.291)	(0.268)	(0.386)	(−2.794)		(4.582)	
4	−2.594	−0.003	0.250	−1.306	0.150	0.001	−0.251	0.128	0.156	−0.043			0.030
	(−2.488)	(−0.010)	(1.394)	(−2.106)	(0.304)	(1.177)	(−1.110)	(0.442)	(0.884)	(−2.616)			(3.081)

For each of the 16,207 'manager-funds' in our sample we first estimate the manager time series alpha from a Carhart four-factor model. We then estimate a cross-sectional regression of these manager alphas on the manager characteristics. Each row reports alternative versions of this cross-sectional regression. The table shows the OLS coefficient on each characteristic and the t-statistic in parentheses. The coefficients are scaled by 10^3 for ease of presentation. Results relate to the sample period January 1990 – July 2015.

Table 4
Manager performance and characteristics (manager-career).

	Inpt	Gender	CFA	PhD	MBA	SAT	BusUG	Quant	Tenure	Exper	Age
1	−2.077	−0.053	0.541	−0.645	0.687	0.000	−0.471	0.269	0.002	0.008	0.013
	(−1.433)	(−0.116)	(2.268)	(−0.447)	(1.100)	(0.133)	(−1.461)	(0.620)	(0.544)	(2.708)	(0.917)
2	-1.090	-0.123	0.550	-0.958	0.625	-0.000	-0.499	0.264	0.012		
	(−0.865)	(−0.269)	(2.296)	(−0.656)	(0.989)	(−0.008)	(−1.544)	(0.602)	(5.116)		
3	-1.409	-0.020	0.503	-0.650	0.714	0.000	-0.512	0.222		0.010	
	(−1.131)	(−0.045)	(2.134)	(−0.453)	(1.146)	(0.059)	(−1.608)	(0.515)		(5.992)	
4	-3.004	-0.174	0.572	-0.316	0.381	0.001	-0.381	0.297			0.043
	(−2.013)	(0.370)	(2.314)	(−0.211)	(0.591)	(0.642)	(−1.140)	(0.661)			(3.324)

For each of the 6291 unique 'manager-career' time series, we first estimate the time series alpha from a Carhart four-factor model. We then estimate a cross-sectional regression of these manager alphas on the manager characteristics. Each row reports alternative versions of this cross-sectional regression. The table shows the OLS coefficient on each characteristic and the t-statistic in parentheses. The coefficients are scaled by 10^3 for ease of presentation. Results relate to the sample period January 1990 – July 2015.

Table 5
Manager risk, investment style and characteristics (manager-funds).

Inpt	Gender	CFA	PhD	MBA	SAT	BusUG	Quant	Owner	Team Sz	Exper
Market factor										
1096.88	34.718	−17.372	46.831	−29.033	−0.099	13.993	41.628	−33.342	3.247	−0.122
(22.850)	(2.182)	(−1.764)	(1.378)	(−1.069)	(−2.978)	(1.130)	(2.612)	(−3.405)	(3.611)	(−2.004)
Size factor										
332.131	157.92	−37.073	26.105	−151.150	−0.034	−101.33	−57.036	−54.406	4.563	−0.375
(2.448)	(3.511)	(−1.332)	(0.272)	(−1.968)	(−0.363)	(−2.895)	(−1.266)	(−1.965)	(1.795)	(−2.185)
Value factor										
−245.677	−85.513	20.117	−268.748	−20.512	0.285	−17.711	8.675	−56.126	−6.419	0.381
(−2.334)	(−2.451)	(0.932)	(−3.606)	(−0.344)	(3.898)	(−0.652)	(0.248)	(−2.614)	(−3.256)	(2.859)
Momentum factor										
127.400	−19.841	18.771	74.800	26.234	−0.074	−5.894	7.388	−25.704	0.917	−0.186
(2.773)	(−1.303)	(1.992)	(2.300)	(1.009)	(−2.335)	(−0.497)	(0.484)	(−2.743)	(1.066)	(−3.206)
Idiosyncratic risk										
0.452	0.081	−0.038	−0.010	−0.095	−0.000	−0.030	−0.116	−0.064	−0.015	0.000
(3.721)	(1.996)	(−1.521)	(−0.113)	(−1.339)	(−1.242)	(−0.942)	(−2.832)	(−2.592)	(−6.760)	(0.948)

For each of the 16,207 'manager-funds' in our sample we first estimate the Carhart four-factor model and store the factor loadings. We also estimate and store idiosyncratic risk as the variance of the estimated residuals. We then estimate separate cross-sectional regressions of the factor loadings (expression 3 in the text) and idiosyncratic risk (expression 4 in the text) on the manager characteristics. The table shows the OLS coefficient on each characteristic and the t-statistic in parentheses. The coefficients are scaled by 10^3 for ease of presentation. Results relate to the sample period January 1990 – July 2015.

we estimate expressions [3] and [4] to ascertain whether there is a relationship between the characteristics of a manager and their exposure to the Carhart risk factors (expression 3) and idiosyncratic risk (expression 4). The results in Table 5 include only the Experience characteristic variable as a representation of manager wisdom. The results are almost identical when we use Age, and Tenure and so in the interests of parsimony we do not present these results; they are available on request.

The first row in table presents the relationship between the *Market* risk factor and our set of manager characteristics. We find that a number of the characteristic variables have a statistically significant relationship with this risk factor. Female managers have a lower exposure to this risk factor than their male counterparts. With regard to educational attainment, we find that CFA chartered managers and managers that graduated from universities with high SAT score entry requirements, both tend to have a lower exposure to this factor, while managers with a quant-based degree qualification tend to have higher exposure to market risk. We also find that managers with a stake in their fund have a lower exposure to this factor, while funds with larger teams tend to have a higher exposure to it. Finally, more experienced managers tend to have a lower exposure to market risk.

The second row in Table 5 shows that there are significant relationships between the characteristics' variables and the *Size* risk factor. Male managers tend to have a higher exposure to the size risk factor, while managers with an MBA, or with a Business-related degree tend to have a lower exposure to this risk factor and therefore, by deduction a preference for larger cap stocks. We also find that managers with a stake in the fund have a lower exposure to this factor, and finally that more experienced managers also have, on average, a lower exposure to this risk factor.

Row 3 of Table 5 shows the estimated relationship between the manager characteristics and the Value risk factor. While female managers tend to have lower exposure to the market risk and size factors than male managers, they tend to have a higher exposure to the Value risk factor. Managers with a PhD also tend to have a lower exposure to this risk factor while those managers that graduated from universities with high SAT score entry requirements tend to have a higher exposure to this factor. We also find that managers with a stake in the fund and larger management teams have lower exposure to the Value Factor. Finally, we find that managers with greater experience tend to have a higher exposure to the Value risk factor.

The results relating to the Momentum risk factor, presented in row 4 of Table 5, show that managers that are CFA qualified or that hold a PhD are likely to have a positive tilt to this factor in their portfolios, while those managers that graduated from universities with high SAT score entry requirements tend have a lower exposure to the factor. We also find that an ownership stake leads to a lower exposure to this factor. Finally, more experienced managers also tend to have a lower exposure to this factor.

The final row in Table 5 presents the results from estimating expression [4] in the text. Focussing again only on the statistically significant coefficients, we find that the funds managed by male managers have a higher exposure to idiosyncratic risk compared with those managed by female managers. Also, those managers with a quant-based degree, an ownership stake in the fund and those that are part of a larger team, tend to have a lower exposure to idiosyncratic risk.

We can summarise the results in another way. Looking at the coefficient on the Gender variable we conclude from these that compared to female managers, male managers have, on average: a higher exposure to the market and size risk factors; lower exposure to the value risk factor; and more exposure to idiosyncratic risks. Focussing on the sign and significance of the coefficients on the Team Size variable, we conclude from these regressions that the funds managed by larger teams have very similar risk exposures to those of male fund managers. Finally, when we consider the coefficients in Table 5 on the Experience characteristic we conclude that more experienced fund managers, those with more wisdom, run portfolios that have: lower exposure to the market, size and momentum risk factors; higher exposure to the Value risk factor; and no significant exposure to idiosyncratic risks.

Perhaps the most intriguing set of results in Table 5 relate to the coefficients on the Ownership variable, where all of the coefficients are found to be statistically significant and negative. This suggests that with respect to all of these sources of risk, managers with an ownership stake in the fund take less risk.

5.3. Manager performance persistence results

Our results clearly show that some manager characteristics influence relative performance among the cross-section of managers, particularly variables that proxy for what we could call wisdom. In addition to performance, the role of performance *persistence* in the mutual fund industry has also attracted a great deal of attention in the last couple of decades. However, there is a dearth of analysis on the relevance of, and role played by, manager characteristics in this persistence. In this study, we turn our attention to this largely unexplored area. Initially, we investigate persistence by eleven manager characteristics. We then examine possible interaction effects between characteristics in persistence.

Table 6 presents results of the performance persistence tests described in section 4. The rows of the table present the results by each of the eleven manager characteristics as indicated, for example by gender denoted “Male Managers” and “Female Managers”. We report results for the 1-month holding period returns for decile sorted managers over the previous 36 months. The table shows the monthly alpha, t-statistic of alpha and the bootstrap *p*-value of the t-statistic of alpha for each of these decile regressions, denoted “Decile 1” to “Decile 10”.[6] Also shown are the alpha, t-statistic and bootstrap p-value of the t-statistic of a portfolio of the top decile minus the bottom decile of managers within each characteristic, denoted “Decile 1 – 10”, for example, the top decile of male managers minus the bottom decile of male managers.[7] Finally, the last column of the table shows the alpha, t-statistic and bootstrap p-value of a portfolio of the top decile minus the bottom decile of managers across characteristics, denoted “Decile 1 – 1”, for example, the top decile of male managers minus the top decile of female managers. Newey-West adjusted t-statistics are calculated throughout. Results relate to the slightly later sample period January 1995 – July 2015 in order for there to be a sufficient number of manager observations within each characteristic.

The first row shows results for the full sample (i.e., including all characteristics) of 6291 unique ‘manager-career’ returns. Here, as described in section 3, we concatenate each manager’s returns as they switch between funds over their career into a single manager-career return series. The second row shows results for the full sample of 16,207 ‘manager-funds’. Again, as described in section 2, here managers may enter the sample more than once if they manage more than one fund at a time and/or if they manage different funds at different time periods in the sample. In the remaining rows of the table, the analysis is performed separately for each manager characteristic across the 16,207 manager-funds.

From Table 6, row 1, looking at manager-career performance persistence, we see that the holding period alpha of the top decile of managers is 0.146% per month. Its ‘conventional’ t-statistic of 2.355 and the bootstrap *p*-value of the t-statistic of 0.010 are both statistically significant at the 1% significance level (one-tail test). Over the remaining deciles from decile 2 to decile 10, the holding period alpha changes sign from positive to negative but is not statistically significant in any case. From the second last column of Table 6, we see that the holding period alpha of the top minus bottom decile of manager-career returns is 0.185% pm, which is significant at the 5% significance level according to both the t-statistic and the bootstrap p-value of the t-statistic. From row 2, looking at performance persistence over the full sample of 16,207 manager-funds, we that the results are qualitatively very similar to the manager-career returns in row 1. The holding period alpha of the top decile is 0.136% pm which is significant at the 5% significance level by both the t-statistic and bootstrap p-value, all other decile alphas are not significant while the alpha of the top minus bottom decile of manager-funds yields a positive and significant alpha by both the t-statistic and bootstrap p-value at the 5% significance level.

Overall, therefore, our results provide strong evidence of persistence at the manager level in the top decile of managers based on a 36-month sorting period and a 1-month holding. This result is strongly consistent over both ‘manager-career’ returns and ‘manager-fund’ returns. There is some ambiguity in the mutual fund performance literature generally around whether performance lies at the level of the manager or the fund.

[6] We report bootstrap-*p*-values of the t-statistic of alpha to account for non-normality in the returns data. This is particularly observed in the tails of the cross-sectional distribution of manager returns, e.g., top decile. We choose bootstrap values of the t-statistic as the t-statistic provides improved reliability in cases of short return histories.

[7] We do not present this analysis as a possible trading strategy for investors. Firstly, due to the large numbers of funds, it would not be practical for investors to hold deciles. Secondly, it is not possible in practice for investors to short mutual funds. These results are merely intended to provide insight into the relative persistence of top and bottom sorted managers in the cross-section.

Table 6
Performance persistence by manager characteristic (manager-funds).

		Decile 1	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6	Decile 7	Decile 8	Decile 9	Decile 10	Decile 1–10	Decile 1–1
All (6291)													
Manager-	alpha	0.146	0.058	0.043	−0.028	−0.040	−0.029	−0.006	−0.011	−0.060	−0.039	0.185	
Career	t-alpha	2.355	1.003	0.738	−0.476	−0.652	−0.453	−0.086	−0.154	−0.770	−0.519	2.068	
	p-value	0.010	0.139	0.245	0.671	0.743	0.659	0.527	0.574	0.787	0.702	0.019	
All (16,207) Manager-Fund	alpha	0.136	−0.003	0.007	0.028	−0.071	−0.010	0.012	−0.019	−0.023	−0.021	0.158	
	t-alpha	2.266	−0.058	0.127	0.544	−1.082	−0.158	0.177	−0.242	−0.301	−0.271	1.755	
	p-value	0.013	0.498	0.445	0.292	0.835	0.557	0.430	0.604	0.622	0.604	0.038	
Male	alpha	0.148	−0.002	0.011	0.035	−0.073	−0.011	−0.001	−0.010	−0.020	−0.001	0.149	
Managers	t-alpha	2.449	−0.049	0.181	0.644	−1.090	−0.186	−0.001	−0.133	−0.270	−0.001	1.641	
	p-value	0.007	0.487	0.416	0.256	0.841	0.578	0.505	0.572	0.613	0.491	0.049	
Female	alpha	0.052	−0.036	−0.006	−0.022	0.091	−0.051	−0.172	0.002	−0.003	−0.173	0.226	0.096
Managers	t-alpha	0.665	−0.457	−0.087	−0.263	1.049	−0.657	−1.688	0.249	−0.033	−1.783	2.180	1.508
	p-value	0.278	0.669	0.548	0.602	0.141	0.721	0.968	0.497	0.518	0.965	0.011	0.043
CFA	alpha	0.109	−0.029	0.412	−0.015	−0.056	−0.080	−0.008	−0.041	−0.026	0.063	0.046	
	t-alpha	1.810	−0.462	0.601	−0.243	−0.694	−1.074	−0.128	−0.522	−0.309	0.707	0.503	
	p-value	0.039	0.665	0.288	0.602	0.742	0.851	0.556	0.704	0.630	0.243	0.315	
Non-CFA	alpha	0.178	0.017	−0.004	0.043	−0.039	0.022	0.023	0.032	−0.012	−0.031	0.210	−0.069
	t-alpha	2.771	0.329	−0.069	0.649	−0.631	0.333	0.328	0.382	−0.156	−0.373	2.457	−1.606
	p-value	0.003	0.370	0.540	0.266	0.713	0.363	0.379	0.365	0.564	0.644	0.005	0.949
MBA	alpha	0.131	0.010	0.061	0.032	−0.090	−0.001	−0.006	0.003	0.028	0.015	0.115	
	t-alpha	1.969	0.177	0.839	0.549	−1.217	−0.001	−0.084	0.040	0.353	0.186	1.186	
	p-value	0.022	0.413	0.197	0.297	0.887	0.496	0.542	0.493	0.365	0.405	0.118	
Non-MBA	alpha	0.147	−0.018	0.001	0.035	−0.067	−0.044	0.049	−0.001	−0.061	−0.011	0.159	−0.016
	t-alpha	2.478	−0.309	0.009	0.555	−0.946	−0.676	0.651	−0.005	−0.739	−0.136	2.102	−0.441
	p-value	0.008	0.609	0.515	0.285	0.815	0.732	0.266	0.499	0.783	0.549	0.026	0.657
Doctorate	alpha	0.044	0.046	0.075	−0.067	−0.134	−0.031	−0.140	0.049	0.059	0.037	−0.025	
	t-alpha	0.287	0.316	0.513	−0.698	−1.400	−0.267	−1.036	0.412	0.508	0.302	−0.104	
	p-value	0.395	0.396	0.298	0.763	0.902	0.633	0.850	0.362	0.303	0.345	0.532	
Non	alpha	0.113	−0.031	−0.054	0.047	−0.072	0.003	−0.025	−0.036	−0.056	−0.023	0.142	−0.111
Doctorate	t-alpha	1.998	−0.561	−0.893	0.794	−1.226	0.051	−0.448	−0.519	−0.838	−0.319	1.925	−0.763
	p-value	0.019	0.715	0.815	0.233	0.885	0.461	0.672	0.682	0.783	0.614	0.032	0.783
BUSUG	alpha	0.111	−0.147	−0.041	0.013	−0.038	0.056	0.007	−0.001	0.044	0.027	0.084	
	t-alpha	1.456	−1.712	−0.562	0.135	−0.455	0.608	0.092	−0.002	0.451	0.218	0.781	
	p-value	0.071	0.968	0.713	0.437	0.654	0.279	0.475	0.492	0.329	0.425	0.221	
Non-BUSUG	alpha	0.070	−0.076	0.168	−0.078	−0.113	−0.065	−0.059	−0.011	−0.057	−0.070	0.141	0.040
	t-alpha	0.581	−0.699	1.487	−0.747	−1.189	−0.557	−0.465	−0.121	−0.610	−0.740	1.018	0.353
	p-value	0.295	0.757	0.065	0.781	0.867	0.699	0.684	0.546	0.733	0.770	0.153	0.385
Quant	alpha	0.371	−0.343	−0.051	−0.075	0.012	0.024	0.182	−0.129	−0.134	−0.073	0.445	
	t-alpha	2.667	−2.481	−0.408	−0.691	0.114	0.172	1.691	−1.204	−1.035	−0.651	2.635	
	p-value	0.002	0.997	0.651	0.756	0.444	0.462	0.040	0.883	0.852	0.749	0.003	
Non-Quant	alpha	0.078	−0.095	−0.045	−0.053	−0.025	−0.031	0.044	0.012	0.024	0.014	0.064	0.293
	t-alpha	1.100	−1.095	−0.596	−0.649	−0.298	−0.376	0.546	0.143	0.286	0.128	0.659	2.106
	p-value	0.148	0.869	0.734	0.754	0.601	0.648	0.318	0.433	0.393	0.451	0.247	0.012
SAT-High	alpha	0.211	−0.020	−0.032	0.042	0.002	−0.008	0.008	−0.027	0.010	0.021	0.189	
	t-alpha	2.482	−0.377	−0.452	0.603	0.034	−0.137	0.111	−0.366	0.130	0.257	1.758	
	p-value	0.006	0.594	0.661	0.275	0.495	0.547	0.463	0.642	0.462	0.408	0.040	
SAT-Low	alpha	0.100	−0.054	0.042	−0.085	−0.093	−0.053	0.016	−0.067	0.028	−0.030	0.131	0.110
	t-alpha	1.404	−0.724	0.563	−1.093	−1.186	−0.709	0.167	−0.752	0.364	−0.334	1.273	1.740
	p-value	0.082	0.766	0.283	0.876	0.862	0.755	0.474	0.753	0.358	0.634	0.104	0.046
Tenure	alpha	0.155	0.006	0.004	0.034	−0.046	0.018	0.015	−0.001	0.006	0.008	0.147	
Long	t-alpha	2.452	0.120	0.079	0.605	−0.786	0.306	0.236	−0.008	0.079	0.094	1.531	
	p-value	0.007	0.418	0.478	0.271	0.763	0.378	0.419	0.510	0.481	0.460	0.073	
Tenure	alpha	0.055	0.001	0.048	−0.058	−0.133	−0.073	0.000	−0.075	−0.096	−0.088	0.143	0.100
Short	t-alpha	0.81	0.016	0.603	−0.919	−1.494	−0.901	0.001	−0.887	−1.286	−1.102	1.581	1.993
	p-value	0.205	0.492	0.274	0.808	0.930	0.802	0.486	0.811	0.909	0.861	0.057	0.024
Experience	alpha	0.158	0.013	0.032	0.030	−0.047	0.019	0.027	−0.008	−0.009	0.012	0.145	
Long	t-alpha	2.519	0.242	0.524	0.515	−0.680	0.317	0.370	−0.104	−0.126	0.150	1.556	
	p-value	0.007	0.381	0.307	0.299	0.730	0.374	0.371	0.550	0.543	0.440	0.063	
Experience	alpha	0.037	−0.092	−0.002	−0.057	−0.173	−0.131	−0.036	−0.113	−0.062	−0.153	0.190	0.121
Short	t-alpha	0.533	−1.565	−0.041	−0.972	−2.214	−2.019	−0.462	−1.183	−0.959	−2.081	2.074	2.773
	p-value	0.330	0.943	0.533	0.813	0.990	0.979	0.681	0.868	0.842	0.984	0.019	0.003
Age	alpha	0.184	−0.037	0.027	0.022	−0.089	−0.004	−0.008	0.010	0.036	−0.018	0.203	
Older	t-alpha	2.462	−0.630	0.373	0.377	−1.255	−0.062	−0.094	0.137	0.445	−0.206	2.061	
	p-value	0.007	0.726	0.359	0.365	0.881	0.530	0.559	0.452	0.334	0.575	0.018	
Age	alpha	0.100	−0.052	−0.021	−0.007	−0.040	−0.059	−0.001	−0.083	−0.090	0.019	0.081	0.083
Younger	t-alpha	1.214	−0.912	−0.264	−0.099	−0.637	−0.903	−0.011	−0.954	−1.091	0.240	0.719	1.140
	p-value	0.126	0.814	0.598	0.522	0.720	0.801	0.515	0.823	0.871	0.405	0.242	0.111
Owner	alpha	0.161	0.009	0.012	0.089	−0.035	0.066	0.096	0.044	0.057	0.090	0.071	
	t-alpha	2.483	0.159	0.163	1.193	−0.409	0.783	1.190	0.531	0.681	0.908	0.798	
	p-value	0.007	0.434	0.453	0.113	0.675	0.221	0.142	0.332	0.240	0.174	0.210	
Non-Owner	alpha	0.112	−0.011	−0.031	−0.005	−0.127	−0.018	−0.050	−0.063	−0.070	−0.071	0.183	0.048
	t-alpha	1.621	−0.224	−0.504	−0.092	−2.038	−0.301	−0.607	−0.783	−0.996	−0.912	1.897	0.791
	p-value	0.063	0.583	0.688	0.534	0.975	0.605	0.761	0.769	0.841	0.817	0.030	0.221

This table presents the performance persistence results of decile sorted managers. The first row shows results for 6291 unique 'manager-career' returns. The second row shows results for 16,207 'manager-funds'. In the remaining rows of the table, the analysis is performed separately for each manager characteristic across the 16,207 manager-funds. Each month funds are sorted into equally weighted decile portfolios based on the t-statistic of alpha from a Carhart four-factor model estimated over the previous 36 months formation period. Each decile portfolio is held for a one month holding period and the process is repeated on a one month rolling basis. A time series of holding period returns is generated for each decile and the model is estimated in each case over the holding period returns. The table shows the monthly alpha, t-statistic of alpha and the bootstrap *p*-value of the t-statistic of alpha for each of these decile regressions, denoted "Decile 1" to "Decile 10". Also shown are the alpha, t-statistic and bootstrap *p*-value of a portfolio of the top decile minus the bottom decile of managers within each characteristic, denoted "Decile 1 – 10". Finally, the last column of the table shows the alpha, t-statistic and bootstrap *p*-value of a portfolio of the top decile minus the bottom decile of managers across characteristics, denoted "Decile 1 – 1", for example, the top decile of male managers minus the top decile of female managers. Newey-West adjusted t-statistics are calculated throughout. Results relate to the sample period January 1995 – July 2015.

Our former finding of persistence ranked manager-career returns speaks to *manager* talent as this persistence is found even as managers move between funds over their career. However, the latter finding of persistence among manager-fund returns is reassuring for investors as it indicates that investors can enjoy performance persistence (among top decile manager-funds) without having to monitor managers career moves and switch funds accordingly.

For reasons of parsimony we do not present results over the many possible combinations of sorting and holding period lengths. We find that the above results are qualitatively unchanged over various holding periods up to 6 months. However, on using a 60-month (instead of 36-month) sorting period, the evidence of persistence weakens considerably. This indicates that relatively recent manager performance is the better predictor of future performance.

In Table 6 the remaining rows present the persistence findings by characteristic as indicated. In the case of each binary characteristic, we split the sample and perform the persistence tests on each subgroup separately, for example for male managers and female managers. For SAT score, tenure, experience and age, in each case we form the two subgroups according to whether managers are above or below the sample mean values of the characteristics as follows: SAT (1331), tenure (62.63 months), experience (103.25 months) and age (45.62 years). In the case of tenure, experience and age the sample split values are based on the final observation in time for each manager-fund.

From Table 6, there is evidence of persistence among the top decile of male managers in our sample where the top decile yields a holding period or 'forward-looking' alpha of 0.148% pm – statistically significant at the 1% significance level (one-tail test) by both the conventional t-statistic as well as the bootstrap *p*-value. All other deciles of male managers do not indicate a significant value of alpha. From the second last column of Table 6, we see that the top decile of male managers goes on to outperform the bottom decile of managers by a value of 0.149% pm – marginally significant at the 5% significance level. Although the top decile of female managers in the sample go on to yield a significant alpha of 0.052% pm, this is not statistically significant. Indeed, none of the deciles of female managers yields a significant holding period alpha. However, the top decile of female managers outperforms the bottom decile of female managers by 0.226% pm – significant at the 5% significance level. From the last column of Table 6, denoted "Decile 1–1", we see that from our sample of managers, a portfolio consisting of the top decile of male managers minus the top decile of female managers yields a holding period alpha of 0.096% pm – significant at the 5% level by the bootstrap p-value. These results provide initial evidence that based on a three-year evaluation period, top performing male managers go on to outperform top performing female managers over the following month.

Scanning over the rows of Table 6 related to manager persistence by education and qualifications characteristics, there is evidence of persistence among the top decile of CFA qualified managers as well as among the top decile of non-CFA managers and the top decile of non-CFA managers go on to outperform the bottom decile of non-CFAs by a significant 0.21% pm. However, our results based on manager-fund returns in Table 3 do not support a significant positive role for the CFA designation among the cross-section of manager-fund performance and we find from Table 6 that in terms of manager *persistence*, the top decile of non-CFA managers (as measured over the previous 36 months) go on to outperform the top decile of CFA managers in the following month. This finding is bordering on significant at the 5% significance level and is robust to alternative holding periods longer than one month. However, this finding is not significant over sorting periods longer than 36 months. From Table 6, our results on the role of MBA and doctoral qualifications in manager performance persistence are not especially remarkable: the top deciles of non-MBAs and non-doctorate managers go on to outperform the bottom deciles in both cases. However, we find no significant difference in performance persistence between (i) the top decile of MBAs versus the top decile of non-MBAs or (ii) the top decile of managers with doctorates versus the top decile of managers without doctorates. We find no significant role for whether a manager's undergraduate degree is a business degree or non-business degree in manager persistence. However, whether a manager holds a quantitative or non-quantitative degree is shown to be relevant in performance persistence. The top decile of 'quant' managers go on to significantly outperform the bottom decile of 'quant' managers and also go on to significantly outperform the top decile of 'non-quant' managers. Our findings relating to SAT scores are very similar: The top decile of high (above average) SAT score managers go on to significantly outperform the bottom decile of high SAT score managers and, again, also go on to significantly outperform the top decile of low (below average) SAT score managers.

From our earlier discussion of the cross-sectional results in Table 6 about the relation between manager-fund performance and manager characteristics, we reported strong evidence that manager tenure, experience and age have a significant role to play in manager performance. The results in Table 6 indicate that these characteristics are also relevant in performance persistence. We find persistence among managers of both long and short tenure and long and short experience – bordering on statistically significant at the 5% significance level. However, in particular, long tenure managers (top decile) go on to outperform short tenure managers (bottom decile) by a significant 0.10% pm. Similarly, long experience managers go on to outperform short experience managers by a significant 0.12% pm. The findings on manager age are less statistically significant: although the top decile of older managers (above average age) outperform the bottom decile of older managers, the top decile of older managers outperforms the top decile of younger managers by 0.083% pm – bordering on statistically significant at only the 10% significance level.

Finally, among managers with an ownership stake in the fund, we find persistence among the top decile. However, we do not find evidence that the top decile of managers with an ownership stake go on to outperform the top decile of managers without any personal investment in the fund they are managing.

A consistent finding across our persistence tests by manager characteristic is that where persistence is found in the top decile of managers it is robust to longer holding periods than one month. However, the persistence results are more sensitive to increasing the evaluation period to greater than three years.

A complication in interpreting the results of the above persistence analysis is that, unlike in the previous cross-sectional regressions, there may be interaction effects among the manager characteristics that the persistence testing methodology does not take direct account of. Some of the strongest, most interesting and curious results in Table 6 include the persistence findings around experience, gender and the role of the CFA designation. Here, we attempt to further investigate possible interactions within these key findings. Results are reported in Table 7.

In each panel we double-sort our sample by two characteristics into four subgroups and test for persistence in each of the four subgroups. However, controlling for one characteristic, we then examine whether there is a difference in performance persistence between the top deciles of the other characteristic. For example, in Panel A we first sort the sample by gender and then subdivide these groups by long (above average) versus short (below average) experience and present persistence test results for the top decile of each of the four subgroups. Then, within the subgroup of managers with long experience, we test for a difference between the top decile of male managers versus the top decile of female managers, denoted "Men/Women". Similarly, among male managers we test for a difference between the top decile of male manages with long experience versus the top decile of male managers with short experience, denoted "Long/Short" etc. In each case, each cell presents the alpha, t-statistic of alpha and bootstrap *p*-value of the t-statistic of alpha (respectively in vertical order) for the top decile holding period portfolio.

Previously from Table 6, we reported that based on our sample of fund managers the top decile of male managers went on to outperform the top decile of female managers (over the following month). Our results also indicate that long experience managers go on to outperform short experience managers. In Table 7, Panel A, we examine this further. Here, we see that among long (above average) experience managers, the top decile of male managers outperforms go on to the tope decile of female managers by 0.051% pm, however this is not statistically significant with a bootstrap p-value of 0.248. Similarly, among short (below average) experience managers, there is no significant difference in one-month ahead performance between the top decile of male managers and the top decile of female managers. From Panel A, it is also evident that among male managers, the top decile of long experience managers go on to significantly outperform the top decile of short experience managers by 0.14% pm with a *p*-value of 0.002. Among female managers, we do not find a significant difference between long and short experience managers in one-month ahead performance. The results in Panel A tend to suggest that it is experience rather than gender that plays the key role in driving the previous persistence findings around experience and gender.

The other curious finding relates to the role of the CFA designation. Earlier results do not support a significant positive role for the CFA designation among the cross-section of managers while, in terms of manager persistence from Table 6, the top decile of non-CFA managers go on to outperform the top decile of CFA managers one-month ahead. However, from Table 7, Panel B, we see that among both long experience managers and separately among short experience managers, there is no significant difference between CFA and non-CFA manager in one-month ahead performance. However, among CFA managers and non-CFA managers separately, long experience managers go on to significantly outperform short experience managers in both cases (in the case of non-CFA managers the p-value is borderline significant at 0.064). Again, the results in Panel B suggest that it is experience rather than the CFA designation that plays an important role in the previous persistence findings.

Overall, our findings indicate persistence among the top decile of managers. By characteristics, persistence is most evident among male managers, non-CFA managers, 'quant' managers, high SAT score managers, long experience and long tenure managers. There is evidence to suggest, however, that long experience over short experience is a particularly important characteristic and explains much of the findings on persistence around gender and the CFA designation.

6. Conclusions

In this paper we have sought to understand whether a range of manager characteristics have a relationship with manager skill, proxied by alpha, the factor exposures of a manager, and performance persistence. We believe that we have provided a comprehensive analysis of these relations and are, to our knowledge, the first to examine the relationship between manager characteristics and performance persistence. The most consistent result from our estimates of the cross-sectional relationship between manager characteristics and manager skill, proxied by the alpha generated from a Carhart four-factor model, are that accumulated wisdom, however this is proxied, has a positive relationship with manager skill: the longer the manager's tenure, the more experienced the manager is and the older the manager, the better the performance, other things equal. Among other interesting results, when we consider the relationship between these same characteristics and each manager's exposure to the four risk factors in the Carhart model we find that more experienced fund managers tend to run portfolios that have: lower exposure to the market, size and momentum risk factors; higher exposure to the Value risk factor; and no significant exposure to idiosyncratic risks. We also find that when a manager has a stake in a fund they tend to have a lower exposure to all of these risk factors relative to managers without a stake in their fund. To our knowledge we are also the first to look at the relationship between

Table 7
Characteristics interactions in performance persistence (manager-funds).

Panel A: Gender and Experience				Panel B: CFA Designation and Experience			
	Male	Female	Male/Female		CFA	Non-CFA	CFA/ Non-CFA
Experience	0.166	0.115	0.051	Experience	0.152	0.188	−0.035
Long	2.687	1.288	0.742	Long	2.506	2.816	−0.729
	0.005	0.122	0.248		0.013	0.004	0.771
Experience	0.026	0.019	0.007	Experience	−0.094	0.064	−0.158
Short	0.391	0.124	0.047	Short	−0.980	0.776	−1.457
	0.384	0.461	0.464		0.819	0.228	0.926
Long/Short	0.140	0.096		Long/Short	0.246	0.123	
	2.978	0.620			2.732	1.483	
	0.002	0.280			0.004	0.064	

Each panel of the table presents a two-way persistence analysis on the sample of 'manager-funds' where we double-sort our sample by two characteristics into four subgroups. We test for persistence in each of the four subgroups. In addition, controlling for one characteristic, we examine whether there is a difference in performance persistence between the top deciles of the other characteristic. For example, in Panel A we first sort the sample by gender and then subdivide these groups by experience. We report persistence test results for the top decile of each of the four subgroups. Then, within the subgroup of managers with long experience, we test for a difference between the top decile of male managers versus the top decile of female managers, denoted "Male/Female". Similarly, among male managers we test for a difference between the top decile of male manages with long experience versus the top decile of male managers with short experience, denoted "Long/Short" etc. In each case, each cell presents the alpha, t-statistic of alpha and bootstrap *p*-value of the t-statistic of alpha (respectively in vertical order) for the top decile forward looking portfolio. Newey-West adjusted t-statistics are calculated throughout. Results relate to the sample period January 1995 – July 2015.

manager characteristics and performance persistence. With regard to our consideration of performance persistence, we find that performance persistence is most evident among male managers, non-CFA managers, 'quant' managers, high SAT score managers, long experience and managers that have managed their fund for a long period of time. We also find evidence to suggest, however, that long experience over short experience is a particularly important characteristic and explains much of the findings on persistence relating to gender and CFA designation.

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Appendix 1: Example Bios

In this table we present a selection of manager bios. From bios such as these, we extracted the manager characteristics.

Mr. xxxx is a portfolio manager and managing director with xxxx xxxx Investors, which he joined in 1992. He oversees portfolio management and research for the US Small Cap Growth team. Mr. xxxx has more than 22 years of investment-industry experience. Mr. xxxx has a B.A. from Flagler College and an MBA from the Paul Merage School of Business, University of California, Irvine.
Ms. xxxx is a portfolio manager on the xxxx small-micro cap growth and small-mid cap growth strategies. Prior to joining xxxx in 2005, she spent six years at xxxx Group, LLC as vice president and CIO and four years at the xxxx xxxx division of xxxx xxxx Investors. Ms. xxxx began her investment career in 1984 at xxxx Capital Management as a fundamental analyst and portfolio manager. Ms. xxxx holds the CFA designation. Ms. xxxx graduated from Bucknell University with a B.S. in electrical engineering and a B.A. in mathematics. She earned her MBA from Harvard Business School.
xxxx xxxx, President and Chief Investment Officer. Mr. xxxx founded the xxxx, LLC in June of 2002. Mr. xxxx is a CFA Charter holder and a Certified Financial Planner. He is a member of the Illinois and California bar. Mr. xxxx graduated with Distinction in Political Science and Communication from Stanford University in 1974, and earned both his MBA and JD degrees, with Distinction, from Northwestern University in 1978.
Ms. xxxx joined xxxx Capital in 2006 as a Research Analyst. In 2010, she was appointed a Portfolio Manager of the Small Cap Value portfolio. Prior to joining the firm, she worked at xxxx Equity Group, xxxx and xxxx where she was responsible for research coverage in the household and personal care sectors. She is a graduate of Davidson College where she earned a BA degree. Ms. xxxx received her MBA from the NYU Stern School of Business. She is a CFA and member of the CFA Institute.

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