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Institutional investment management: An investor's perspective on the relation between turnover and performance

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ABSTRACT

The main aim of this study is to analyse the relationship between turnover and performance in institutional investment management. For a sample of US equity mutual funds during the period January 1999–December 2014, we show that high-turnover funds do not beat low-turnover funds, since their performances are no different, or even significantly lower. Moreover, we show that investing in past high-turnover mutual funds provides investors with significantly worse results than investing in previously low-turnover funds. Investors aiming to enhance their risk-adjusted returns should therefore consider the turnover ratio level in their fund investment decisions.

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Introduction

The considerable growth of the mutual fund industry has led to a significant number of studies on mutual fund performance. Elton and Gruber (2013) and Ferson (2010) provide a review of this literature. The overall evidence is that, in aggregate, active management of mutual funds does not offer investors any added value, compared to the net return obtained by following a passive strategy.

In this context, some recent studies have developed different active management measures, and explore their relation with funds' results. For instance, Kacperczyk *et al.* (2005) demonstrate that better performing mutual fund managers are those who decide to deviate from their benchmarks and concentrate their investments in a few industries where they can obtain informational advantages. Cremers and Petajisto (2009) suggest that funds outperform their benchmarks when they differ from their portfolios' holdings. In the same vein, Amihud and Goyenko (2013) find that funds with lower coefficients of determination perform better. In contrast, Huang *et al.* (2011) show how funds that increase their specific risk can lead to worse performances than funds that maintain stable risk levels over time.

Notwithstanding, fund investors face some difficulties in constructing these measures, and can fail to accurately determine the level of active management in the fund portfolio. They can, however, easily observe the turnover ratio, as reported in the fund's prospectus, and interpret it as a simple measure of the fund's trading activity, assuming that the higher this ratio, the higher the level of transactions reached by fund managers will be.

In the previous literature on institutional investment management some controversy surrounds the relation between turnover and performance. Some studies do not support a high turnover ratio in mutual fund management, since a higher level has no significant effect on fund performance (Golec, 1996; Gottesman and Morey, 2007; Ippolito, 1989), or may even be negative (Chow *et al.*, 2011; Elton *et al.*, 1993). In addition, Carhart (1997) considers turnover ratio as a proxy of trading costs, and observes that fund performance is reduced in every buy-and-sell transaction. In contrast, other

authors (Dahlquist *et al.*, 2000; Wermers, 2000) conclude that high-turnover funds are able to obtain better results and they are equally or more attractive to risk-averse investors (Taylor and Yoder, 1994). Moreover, using gross returns, Pástor *et al.* (2016) show that the turnover in active funds is positively related to their benchmark-adjusted returns, suggesting that fund managers identify time-varying profit opportunities and trade accordingly.

Therefore, portfolio turnover must be a concern for fund investors aiming to enhance their investment returns. However, they do not know *a priori* the level of turnover assumed in the fund portfolio during a specific period; rather, the fund's prospectus reports the turnover ratio reached during the previous year. Thus, if mutual funds generally reach similar levels of this ratio over two consecutive years, then fund investors could interpret this information as a proxy of the potential turnover the fund will have in the near future.

In this context, the objective of this study is to delve into the relationship between the turnover reported in the fund prospectus and the performance experienced by fund investors. For a sample of US equity mutual funds during the period 1999–2014, we analyse the persistence in the relative level of this characteristic on a year-to-year basis.¹ We find that a fund reaching a specific level of turnover relative to the rest of funds during one year is more than likely to reach a similar level during the following year.

Given this evidence, fund investors could take advantage of the turnover information previously reported in the fund prospectus, and invest accordingly. Hence, we examine the performance of different investment strategies based on the level of lagged-fund turnover. To address this issue, we use a similar procedure to the methodology of Amihud and Goyenko (2013), and create 25 hypothetical portfolios that invest in funds with different levels of lagged turnover and past performance. Results show that investing in funds with a previous low turnover ratio can lead to better performances than investing in previously high-turnover funds.

Despite this evidence, we need to take into account that other variables related to the fund can play an important role in driving the analysis results. As Gallagher *et al.* (2006) and Lavin and Magner (2014) noted, the turnover ratio reached by mutual funds can be influenced by other variables. The managers' remuneration should also be related to both turnover ratio and mutual fund performance. After controlling for factors related to agency problems, efficiency and behavioural bias, we observe that portfolio turnover still impacts negatively on the risk-adjusted net returns that fund investors obtain.

In addition, we apply a vector autoregressive (VAR) model in order to understand the interactions between the turnover, the managers' remuneration and the mutual fund performance. Results show that a shock to the portfolio turnover implies a negative response in the mutual fund performance over time.

In short, this study contributes to the previous literature in several ways. Firstly, our results show that high-turnover funds have not provided investors with greater risk-adjusted returns than low-turnover funds in recent years. In fact, they performed significantly worse after the onset of the 2008–2009 financial crisis. Secondly, we also show that investing in previously low-turnover funds can lead to higher risk-adjusted returns than investing in previously high-turnover funds. Finally, we show that the evidence on the relation of fund investors' risk-adjusted returns and portfolio turnover is not driven by other variables, and a shock to the turnover deteriorates the performance of the fund over time.

The rest of the paper is organised as follows. The next section describes the data and the methodology used in the study. The section thereafter presents the main results. The final section concludes with the main findings.

Performance methodology and data

As we are interested in measuring performance as experienced by fund investors, we first compute the daily fund net return using the daily return index. The daily return index is defined as the daily

account balance experienced by an investor who invested in one share on the inception date. It reflects any uninvested cash accrued to the account (future distributions and daily dividends). This data is from the Morningstar database.

Then we use the Carhart (1997) four-factor model² to calculate the mutual fund performance, as described in Equation (1). This model has been widely applied in the literature to assess portfolio management (Ammann *et al.*, 2012; Bessler *et al.*, 2016; Chen and Chen, 2017; Kacperczyk *et al.*, 2014; Karoui and Meier, 2009).

$$R_{p,t} = \alpha_p + \beta_{1,p}R_{MKT,t} + \beta_{2,p}SMB_t + \beta_{3,p}HML_t + \beta_{4,p}UMD_t + \varepsilon_{p,t} \quad (1)$$

where $R_{p,t}$ is the excess risk-free daily mutual fund return during the period t ; $R_{MKT,t}$ is the excess risk-free daily return of the market factor; and SMB_t , HML_t and UMD_t are the daily returns on the size (*Small-Minus-Big*), value (*High-Minus-Low*), and momentum (*Up-Minus-Down*) factor mimicking portfolios, respectively. The data of the daily factors are from Professor Kenneth R. French's website.

According to the SEC, the turnover ratio is defined as the minimum of purchases and sales experienced by a mutual fund during a year, divided by the average of total net assets (TNA) managed by the mutual fund during the same year. This measure has relative advantages. Firstly, by using the minimum of purchases or sales, investors' flows do not affect the turnover ratio. That is, when a fund has positive (negative) investor flows, purchases (sales) are usually involved, but if they are not also accompanied by sales (purchases), they are not considered when measuring the portfolio turnover (Lavin and Magner, 2014). Moreover, as it is reported in the prospectus, the turnover is directly reviewed by investors, and thus affects their mutual fund decisions. However, this ratio also presents some problems. For instance, we are not able to construct this ratio without data on funds' purchases and sales, which prevents us from replicating this measure to observe whether the portfolio turnover reported in the prospectus is estimated accurately. Being a declared variable, it is not clear whether funds tend to show a turnover close to the industrial average in their prospectus. In addition, because it is reported annually, we are unable to perform a consistent comparison between portfolio turnover and mutual fund performance on a different basis (e.g., monthly). Despite these problems, Morningstar indicates that a low turnover (20–30%) could be interpreted as a buy-and-hold strategy in mutual fund management, while a ratio higher than 100% is related to an investment strategy with considerable buying and selling of securities.

In order to control for the effect of some fund characteristics on the turnover, we also obtain data on the net expense ratio, the total net assets, tracking error and information ratio compared with the fund's benchmark, managers' remuneration, liquidity, number of stocks held in the portfolio and the inception date of each mutual fund.

The mutual fund data are from Morningstar for the period January 1999–December 2014. We split the main period into two sub-periods in order to observe any differences in the results of the analysis. The first sub-period covers the years before the recent financial crisis, and runs from January 1999 to December 2007. The second sub-period runs from January 2008 to December 2014.

Our sample consists of 17 773 US domestic equity share-class funds. However, as the turnover ratio refers to the fund as a whole, we grouped the different share classes belonging to the same fund. Our final sample comprises 4 058 mutual funds.³ There is no survivorship bias in our sample, since we include all the funds in existence during this period, whether or not they disappeared.

Panel A and B of Table 1 show the main descriptive statistics for some fund characteristics during the whole sample period and both sub-periods, as well as for the Carhart (1997) factors. Because the aim of this paper is to compare the fund risk-adjusted net returns among different levels of portfolio turnover, we order the sample according to the fund turnover in year t , and we split the sample into quintiles. We repeat this process for each year until the end of the sample period. The first quintile

Table 1. Descriptive statistics of the sample.

Panel A. Characteristics of mutual funds

	January 1999–December 2014		January 1999–December 2007		January 2008–December 2014	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
TNA (millions)	1 597.16	7 098.06	1 584.30	6 196.40	1 604.41	7 559.20
Annualised return (%)	8.41	20.38	7.74	17.45	9.27	23.61
Turnover (%)	85.06	121.07	90.68	137.91	79.31	100.69
Net expense Ratio (%)	1.24	0.49	1.30	0.51	1.20	0.47

Panel B. Annualised factors returns

	January 1999–December 2014		January 1999–December 2007		January 2008–December 2014	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Market (%)	7.80	20.39	5.98	18.03	10.12	23.06
SMB (%)	4.41	10.20	5.40	10.23	3.14	10.16
HML (%)	3.51	10.71	5.98	10.62	0.33	10.81
UMD (%)	4.53	16.34	10.38	14.62	−2.97	18.31

Panel C. Annualised portfolio return and risk, quintiles sorted on turnover

	January 1999–December 2014			January 1999–December 2007			January 2008–December 2014		
	Turnover (%)	Return (%)	Risk (%)	Turnover (%)	Return (%)	Risk (%)	Turnover (%)	Return (%)	Risk (%)
Quintile 1 (low)	14.04	8.07	19.64	14.80	6.85	16.46	13.25	9.63	23.09
Quintile 2	36.79	8.35	19.75	39.60	7.43	16.44	33.91	9.53	23.33
Quintile 3	61.18	8.22	20.08	65.67	7.22	16.88	56.60	9.50	23.57
Quintile 4	95.10	8.79	20.91	101.64	8.35	17.99	88.43	9.35	24.14
Quintile 5 (high)	218.39	8.62	21.45	231.93	8.84	19.32	204.56	8.34	23.90

Notes. This table shows the mean and standard deviation for the following mutual fund characteristics (Panel A): total net assets (TNA), annualised return, turnover and net expense ratios. Panel B shows the same descriptive statistics for the returns of the factors considered in the Carhart (1997) four-factor model. Panel C reports the average turnover ratio, the annualised return, and the standard deviation of the returns (Risk) for the mutual funds belonging to each quintile (sorting on turnover ratio).

comprises the lowest-turnover funds, and the fifth quintile contains the highest-turnover funds. Panel C of Table 1 shows the average turnover ratio of the funds in each quintile, as well as their annual return and risk.

Panel A and Panel B reveal differences in the data when considering the two sub-periods, which can lead to different results. Firstly, the first (second) sub-period is characterised by its lower (higher) return and lower (higher) risk. Thus, as the first row of Panel B shows, the return of the market factor is 5.98% (10.12%), and the risk is 18.03% (23.06%) for the first (second) sub-period. The second sub-period is therefore more volatile. For mutual funds, as the second row of Panel A shows, these values are, respectively, 7.74% (9.27%) in return and 17.45% (23.61%) in risk.

Panel C also shows that mutual funds with different levels of portfolio turnover experience different returns and risks. First of all, high-turnover funds bear higher volatility (21.45%) than low-turnover funds during the whole period (19.64%). These differences remain in both sub-periods. Regarding the fund return, high-turnover funds (quintiles 4 and 5) achieve better returns during the first sub-period than low-turnover funds, but the opposite is found for the second sub-period, where quintile 1 obtains better returns (9.63%).

In summary, Table 1 shows that there are differences in the mean return and risk of mutual funds with different levels of portfolio turnover. Consequently, in the next section we explore in greater depth the dynamics of the level of portfolio turnover and its interaction with fund performance in order to analyse whether mutual funds assuming higher levels of portfolio turnover provide investors with any added value in terms of risk-adjusted return.

Results

Mutual fund performance and portfolio turnover

Given the evidence in Table 1 for the differences in terms of return and risk among funds with different levels of portfolio turnover, we now analyse whether these funds differ significantly in terms of performance.

To address this issue, we form quintile-portfolios, a usual approach in the previous literature (Vargas *et al.*, 2014; among others). Specifically, for each year t , we calculate the average daily returns of five equally-weighted portfolios which invest yearly in mutual funds with similar levels of turnover. Thus, portfolio-quintile ‘Low’ includes funds with the lowest portfolio turnover, while portfolio-quintile ‘High’ comprises the highest-turnover funds. Then, to estimate the portfolio performance, we regress each portfolio daily return according to the Carhart (1997) four-factor model.

Table 2 shows the results of the regressions for the whole period (Panel A) and both sub-periods (Panel B and Panel C). As we aim to compare the performances of the lowest and the highest quintile to verify whether mutual funds assuming high turnover ratios provide investors with any added value in relation to low-turnover funds, we also include the results of their performance differences in the last column.

Results in Table 2 indicate that, in general, mutual funds underperform the market, although this underperformance is only significant in the second sub-period (annualised alpha: -1.5%). We also find no significant differences in the alphas of the funds with the lowest and the highest levels of turnover during the first sub-period. However, results for the second sub-period (Panel C) show that fund performance worsens as a higher level of portfolio turnover is achieved. Concretely, the lowest-turnover funds have an alpha of -0.7% per year (t-statistic: -2.07), and this performance decreases as we move into higher portfolio-quintiles, reaching -2.7% per year (t-statistic: -3.24) for portfolio ‘High’. In other words, in terms of annualised risk-adjusted returns, high-turnover funds significantly underperform low-turnover funds by 200 basis points per year (t-statistic: 2.83).

Table 2. Performance results, based on sorting on fund turnover rate.

Panel A: January 1999–December 2014							
	Low	2	3	4	High	All	Low-High
α_p (annualised)	−0.001 (−0.17)	−0.001 (−0.25)	−0.005 (−0.95)	−0.004 (−0.72)	−0.009 (−1.27)	−0.004 (−0.83)	0.008 (1.16)
Adj. R^2	0.994	0.992	0.991	0.988	0.982	0.992	
Panel B: January 1999–December 2007							
	Low	2	3	4	High	All	Low-High
α_p (annualised)	0.001 (0.16)	0.001 (0.11)	−0.005 (−0.77)	0.001 (0.15)	0.001 (0.10)	−0.000 (−0.04)	−0.000 (−0.02)
Adj. R^2	0.993	0.990	0.988	0.981	0.973	0.989	
Panel C: January 2008–December 2014							
	Low	2	3	4	High	All	Low-High
α_p (annualised)	−0.007** (−2.07)	−0.011** (−2.25)	−0.013** (−2.34)	−0.018*** (−2.75)	−0.027*** (−3.24)	−0.015*** (−2.85)	0.020*** (2.83)
Adj. R^2	0.998	0.997	0.996	0.995	0.991	0.997	

Notes. This table reports the performance quintile-portfolios that invest in funds according to their turnover. The performance is measured as the intercept (α) of the four-factor model. The performance difference between the portfolios investing in funds with the lowest and the highest portfolio turnover (*Low-High*) are also reported. ‘*’, ‘**’, and ‘***’ denote significance at 10%, 5%, and 1% levels, respectively. T-statistics (in parentheses) are from Newey-West’s (1987) heteroscedasticity and autocorrelation consistent covariance estimator.

Turnover persistence

In this section, we focus on the evolution of the turnover for a mutual fund in order to predict the future behaviour of this fund characteristic. In other words, we wonder if, given a specific level of fund turnover during a year, mutual funds reach a similar level during the following year.

To address this question, we form contingency tables, which have been previously used in the literature to demonstrate if fund performance is persistent over time (Brown and Goetzmann, 1995; Malkiel, 1995). This methodology is suitable to observe the association among several variables, in this case, the annual turnover reached by a fund during two consecutive years. Thus, for each fund in quintile p in year t , we identify the quintile it will belong to during the following year $t + 1$, or if it disappears (*Gone*).

If there is no persistence in the level of turnover reached by a fund, we could assume that the probability of staying in the same turnover-sorted quintile is 20% (otherwise, 80%). Assuming, therefore, that the sample is binomially distributed, and having a reasonably large data set (more than 30 observations), we can infer a good approximation considering that the sample is normally distributed. Results are shown in Table 3.

Results in Table 3 clearly show a persistence in the level of turnover of the mutual funds (Z-test: 150). Concretely, about 57% of the sample (15,014 of 26,361 fund-year observations) repeats in the same quintile over two consecutive years. Moreover, if we interpret the contiguous quintiles as levels of turnover close to the level reached in the previous year, 91% of the sample has an equal or similar turnover to that achieved during the previous year, relative to the turnover ratio of the other funds of the sample.

Therefore, Table 3 shows that there is evidence that a fund will continue to experience the same or similar turnover level as it reached previously. So, in the next section we are interested in analysing whether fund investors can benefit from turnover persistence to improve their performance.

Performance of investment strategies based on previous portfolio turnover

Analysis of the evolution of mutual funds’ turnover shows it to persist over time. Thus, we could consider the turnover reported in the fund’s prospectus in a given year as a proxy of the level of turnover assumed in the fund portfolio during the following year. In this section we ask whether investors

Table 3. Turnover persistence.

		Fund-year observations into each quintile in year $t + 1$, sorted on turnover rate					Gone	Surviving funds			
		Low	2	3	4	High		Repeat	Don't repeat	All	Z-Test
Fund-year observations into each quintile in year t , sorted on turnover rate	Low	3 801	1 068	246	133	70	827	3 801	1 517	5 318	93.84
	2	1 054	2 632	1 170	350	126	804	2 632	2 700	5 332	53.60
	3	219	1 178	2 365	1 214	311	852	2 365	2 922	5 287	44.96
	4	83	312	1 228	2 576	1 058	879	2 576	2 681	5 257	52.57
	High	53	115	306	1 053	3 640	965	3 640	1 527	5 167	90.66
All funds		5 210	5 305	5 315	5 326	5 205	4 327	15 014	11 347	26 361	150.00

Notes: This table presents the number of funds that belong to two specific quintiles of ranked fund turnover ratios over a one-year interval. The number of funds that exist for one year but disappear during the following year (*Gone*), the number of funds repeating in the same quintile over two consecutive years (*Repeat*), and the number of funds belonging to different quintiles over two consecutive periods (*Don't Repeat*) are also reported. The Malkiel (1995) Z-test is presented in the last column of the table.

can make fund investment decisions that lead to better risk-adjusted returns, taking past level of turnover as a reference. That is, we analyse whether investors who invest in funds with past low turnover ratios can obtain greater performances than investing in past high-turnover funds.

Following Amihud and Goyenko (2013), we now evaluate an investment strategy based on the past level of fund turnover and past fund performance.⁴ For each year t , we split the sample into quintiles, sorting on fund past turnover ratio. Then, for each quintile we reorder the subsample into quintiles, now sorting on their past performance. Thus, for each quintile based on fund turnover, the subsample is divided into five quintiles based on fund performance. Therefore, the sample is grouped into 25 different subgroups. Then we compute the daily returns of each equally-weighted portfolio formed by the funds in each subgroup over the year. We repeat this process for each successive year until the end of the period considered. Hence, the 25 portfolios represent investment strategies based on past performance and past turnover and they are formed by time series of returns from 2000 to 2014. From these returns, finally we estimate the fund performance using the four-factor model. The performance results of these portfolios are reported in Table 4.

Results in Panel A of Table 4 show that almost none of these strategies has a performance significantly different from zero during the whole period 2000–2014. Only the portfolio that invests in funds with past high turnover ratios and low lagged-performance underperforms by 220 basis points per year (t-statistic: -2.05). In addition, this portfolio significantly underperforms the portfolio that invests in funds with low lagged-turnover ratio and low past performance in 170 basis points per year (t-statistic: 2.04).

However, results vary when we consider different sub-periods. On the one hand, the last row of Panel B shows evidence of the persistence in the performance of mutual funds during the first sub-period. For all the mutual funds in the sample ('All' column), a statistically significant difference of 4% annualised (t-statistic: 2.27) is reported between the best-performing funds and the worst-performing funds during the previous year. Regarding the level of fund turnover, we do not find statistically significant differences among the performance of funds with high and low past turnover. However, as columns '4' and 'High' show, it should be considered that only portfolios with a negative and statistically significant alpha (from -1.7% to -3.5% per year) are those that invest in funds with high levels of past turnover and low past performance, while the only portfolios with a positive and statistically significant alpha (between $+1.7\%$ and $+2.2\%$ per year) are those that invest in funds with a relatively low level of past turnover and high past performance, as shown in row 'High' and columns '2' and '3'. In short, Panel B shows that portfolios investing in funds with relatively low (high) past turnover and high (low) past performance obtain a significantly positive (negative) performance during the first sub-period.

On the other hand, Panel C shows that the evidence of persistence in the mutual fund performance disappears during the second sub-period, a result consistent with the findings in Matallín-Sáez *et al.* (2016). In any event, all the portfolios that invest in funds based on their previous turnover, but

Table 4. Fund portfolio α , based on sorting on lagged annual turnover rate and α .**Panel A: January 2000–December 2014**

α_{t-1}	$Turnover_{t-1}$						
	Low	2	3	4	High	All	Low-High
Low	−0.005 (−0.60)	−0.004 (−0.56)	−0.002 (−0.26)	−0.012 (−1.22)	−0.022** (−2.05)	−0.009 (−1.08)	0.017** (2.04)
2	0.000 (0.03)	−0.004 (−0.63)	−0.006 (−0.93)	−0.010 (−1.40)	−0.015* (−1.71)	−0.007 (−1.12)	0.015** (2.09)
3	−0.003 (−0.68)	−0.002 (−0.43)	−0.003 (−0.50)	−0.006 (−0.91)	−0.007 (−0.95)	−0.004 (−0.88)	0.004 (0.45)
4	−0.002 (−0.39)	0.003 (0.45)	0.007 (0.74)	−0.004 (−0.68)	−0.008 (−0.91)	−0.001 (−0.15)	0.006 (0.54)
High	0.002 (0.28)	0.004 (0.64)	0.001 (0.21)	−0.006 (−0.65)	−0.007 (−0.56)	−0.001 (−0.14)	0.009 (0.77)
All	−0.002 (−0.33)	−0.001 (−0.12)	−0.001 (−0.11)	−0.007 (−1.31)	−0.012 (−1.62)	−0.004 (−0.88)	0.010 (1.32)
High-Low	0.007 (0.68)	0.009 (0.87)	0.004 (0.37)	0.007 (0.49)	0.015 (0.93)	0.008 (0.75)	

Panel B: January 2000–December 2007

α_{t-1}	$Turnover_{t-1}$						
	Low	2	3	4	High	All	Low-High
Low	−0.015 (−1.32)	−0.013 (−1.15)	−0.012 (−0.92)	−0.028* (−1.89)	−0.035** (−2.00)	−0.021 (−1.64)	0.020 (1.61)
2	−0.007 (−0.96)	−0.012 (−1.50)	−0.011 (−1.46)	−0.017* (−1.76)	−0.024* (−1.77)	−0.014* (−1.72)	0.016 (1.46)
3	−0.010 (−1.52)	−0.006 (−0.78)	−0.006 (−0.79)	−0.008 (−0.92)	0.004 (0.34)	−0.005 (−0.80)	−0.013 (−0.99)
4	−0.004 (−0.51)	0.010 (1.19)	0.015 (1.00)	0.004 (0.53)	0.010 (0.69)	0.007 (0.94)	−0.014 (−0.81)
High	0.015 (1.63)	0.022** (2.01)	0.017* (1.80)	0.016 (1.10)	0.025 (1.30)	0.019* (1.70)	−0.010 (−0.60)
All	−0.004 (−0.66)	0.000 (0.03)	0.000 (0.06)	−0.006 (−0.82)	−0.004 (−0.35)	−0.003 (−0.40)	0.000 (0.00)
High-Low	0.030** (2.01)	0.035** (2.18)	0.029* (1.86)	0.044** (2.03)	0.060** (2.33)	0.040** (2.27)	

Panel C: January 2008–December 2014

α_{t-1}	$Turnover_{t-1}$						
	Low	2	3	4	High	All	Low-High
Low	−0.011* (−1.71)	−0.010 (−1.23)	−0.011 (−1.32)	−0.016 (−1.64)	−0.023** (−2.12)	−0.014* (−1.89)	0.011 (1.12)
2	−0.002 (−0.37)	−0.011** (−1.98)	−0.014** (−2.04)	−0.015** (−2.20)	−0.023*** (−2.75)	−0.013** (−2.33)	0.021*** (2.66)
3	−0.004 (−1.25)	−0.009* (−1.90)	−0.011* (−1.86)	−0.015** (−2.29)	−0.020*** (−2.60)	−0.012** (−2.46)	0.017** (2.16)
4	−0.010** (−2.29)	−0.014** (−2.16)	−0.014** (−2.20)	−0.021*** (−3.16)	−0.025*** (−3.06)	−0.017*** (−2.96)	0.015** (2.10)
High	−0.015 (−1.60)	−0.013* (−1.66)	−0.023** (−2.53)	−0.023*** (−2.65)	−0.031** (−2.53)	−0.021** (−2.42)	0.016* (1.77)
All	−0.008** (−2.36)	−0.011** (−2.41)	−0.015** (−2.51)	−0.018*** (−2.72)	−0.024*** (−2.93)	−0.015*** (−2.84)	0.016** (2.28)
High-Low	−0.004 (−0.30)	−0.003 (−0.31)	−0.012 (−1.07)	−0.007 (−0.73)	−0.009 (−0.74)	−0.007 (−0.72)	

Notes: This table shows the performance of hypothetical portfolios that invest yearly in mutual funds according to their previous level of portfolio turnover and previous performance. Mutual funds are sorted first on quintiles (from Low to High) according to their turnover ratio and then on quintiles according to their previous performance. Portfolios that invest in mutual funds without sorting on at least one of these characteristics are denoted by All. The performance is measured as the intercept (α) of the four-factor model. The performance differences between Low and High are also reported. *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively. T-statistics (in parentheses) are from Newey-West's (1987) heteroscedasticity and autocorrelation consistent covariance estimator.

not considering their past performance ('All' row), obtain negative and statistically significant alphas. In addition, it is worth noting that this underperformance worsens as the considered level of past turnover increases.

In fact, as shown in the ‘*High*’ column, portfolios that invest in funds with the highest turnover levels have a statistically significant alpha between -2% and -3.1% annualised, depending on the level of past fund performance. Consequently, these portfolios experience the lowest performances shown in Panel C. Indeed, the difference in performance between portfolios that invest in funds with the lowest and the highest level of past turnover and without considering past fund performance (last row of column ‘*Low-High*’) is positive (1.6% per year), and statistically significant (t-statistic: 2.28).

Summing up, results in Table 4 show that since the recent financial crisis portfolios which invest in funds with the lowest levels of past turnover perform better than those investing in funds with the highest past turnover ratios. For the sub-period 2000–2007, these differences are not statistically significant, but we observe that the only portfolios with negative (positive) and statistically significant performances are those that invest in high (low) past turnover funds and have low (high) past performance.

Do other variables drive the effect of turnover on fund performance?

In this section, we analyse the impact of the fund’s turnover ratio on fund performance, but controlling for the effect of other variables. To address this issue, we employ panel data regressions under the following assumptions: firstly, the individual (or specific) effects are uncorrelated with the independent variables (random effects); secondly, there is a correlation between them, so the individual effects can change across funds (fixed effects).

The dependent variable is the yearly alpha of each fund, estimated as the intercept of model (1). The portfolio *Turnover*, as reported in the prospectus of the fund, is considered as an explanatory variable. Additionally, *Remuneration*, measured as the natural logarithm of the annual amount managers receive, is included in the model due to its relevance to the fund investors and because it should influence both turnover ratio and fund performance. We expect that turnover ratio and the managers’ remuneration will negatively affect mutual fund performance, since both variables increase the costs the portfolio has to bear.

As documented in Lavin and Magner (2014), three main dimensions could influence funds’ turnover ratio. The first dimension is related to the efficiency of the fund, that is, decisions that aim to reduce the transaction and operating costs in the portfolio. The second one refers to the agency problems in mutual fund management. Finally, behavioural biases, such as managers’ overconfidence, also play an important role in the level of portfolio turnover. As we are interested in analysing the impact of the turnover on fund performance, we should control for the effect of some variables that could significantly influence portfolio turnover.

Therefore, in the regressions we include variables related to efficiency (the liquidity of the fund measured as the percentage of the average cash the fund holds, or *Liquidity*; and the natural logarithm of the number of stocks held in the portfolio, or *Stocks*); behavioural biases (the previous alpha as a measure of the managers’ overconfidence, or *LagAlpha*) and agency problems (the natural logarithm of the years since inception, or *Age*; the volatility of the fund returns over a year, or *Risk*; the tracking error, or *TrackError*; and the fund’s information ratio, or *InfRatio*). The natural logarithm of the total assets managed by the fund (*Size*) and the net expense ratio (*Expenses*) are considered as control variables. Results are shown in Table 5.

In line with our expectations, the turnover ratio and the managers’ remuneration are negatively related to the risk-adjusted net returns perceived by fund investors during the same year in any of the considered models. Specifically, a 100% increase in the portfolio turnover implies a drop in the annualised performance of between 0.4% and 0.7% per year. Managers’ remuneration also has a negative and statistically significant effect on mutual fund performance (coefficients between -0.348 and -0.394).

In Panel B, we consider the fund performance as a linear function of the past turnover ratio, or *LagTurnover*. Results are very similar to those in Panel A. That is, after removing the impact of some

Table 5. Fund performance as a function of turnover ratio.

	Model 1		Model 2		Model 3	
	Coef.	p-value	Coef.	p-value	Coef.	p-value
Panel A. The effect of turnover ratio on fund performance						
Turnover	−0.007	(0.000)	−0.006	(0.000)	−0.004	(0.007)
Remuneration	−0.023	(0.623)	−0.348	(0.001)	−0.394	(0.001)
Liquidity	−0.017	(0.030)	0.005	(0.474)	0.002	(0.740)
Stocks	−0.075	(0.237)	0.283	(0.174)	0.378	(0.056)
Risk	0.013	(0.078)	0.023	(0.049)	0.134	(0.004)
TrackError	0.018	(0.793)	−0.102	(0.225)	−0.020	(0.758)
InfRatio	−0.038	(0.140)	−0.385	(0.000)	−0.305	(0.000)
Age	−0.605	(0.000)	−3.292	(0.000)	−2.025	(0.019)
LagAlpha	−0.071	(0.000)	−0.242	(0.000)	−0.211	(0.000)
Size	0.273	(0.000)	0.663	(0.000)	0.240	(0.171)
Expenses	−0.360	(0.085)	0.206	(0.865)	0.932	(0.409)
Intercept	−3.581	(0.000)	−2.078	(0.576)	4.825	(0.349)
Random effects	Yes		No		No	
Fixed effects	No		Yes		Yes	
Time dummies	No		No		Yes	
F-test			50.40	(0.000)	40.38	(0.000)
Hausman Test	2 518.77	(0.000)				
R ²	0.048		0.074		0.138	
Panel B. Does portfolio turnover predict fund performance?						
LagTurnover	−0.006	(0.000)	−0.004	(0.049)	−0.003	(0.061)
Remuneration	−0.026	(0.579)	−0.352	(0.001)	−0.398	(0.001)
Liquidity	−0.016	(0.036)	0.003	(0.677)	0.001	(0.880)
Stocks	−0.076	(0.227)	0.263	(0.205)	0.368	(0.062)
Risk	0.010	(0.169)	0.021	(0.073)	0.131	(0.006)
TrackError	0.010	(0.888)	−0.109	(0.196)	−0.023	(0.724)
InfRatio	−0.032	(0.193)	−0.378	(0.000)	−0.298	(0.000)
Age	−0.610	(0.000)	−3.256	(0.000)	−2.030	(0.019)
LagAlpha	−0.072	(0.000)	−0.243	(0.000)	−0.212	(0.000)
Size	0.280	(0.000)	0.683	(0.000)	0.256	(0.146)
Expenses	−0.358	(0.081)	0.260	(0.834)	0.959	(0.405)
Intercept	−3.633	(0.000)	−2.595	(0.498)	4.564	(0.380)
Random effects	Yes		No		No	
Fixed effects	No		Yes		Yes	
Time dummies	No		No		Yes	
F-test			48.63	(0.000)	39.88	(0.000)
Hausman Test	2 546.62	(0.000)				
R ²	0.047		0.073		0.138	

Notes: This table shows the results of panel data regressions. Random effects and fund fixed effects are considered. The dependent variable is the annual performance of the funds, measured as the intercept (α) of the four-factor model. The independent variables are the turnover ratio of the fund (*Turnover*), the natural logarithm of the annual remuneration of the fund managers (*Remuneration*), the average liquidity of the fund (*Liquidity*), the natural logarithm of the number of stocks held in the portfolio (*Stocks*), the volatility of the returns (*Risk*), the tracking error (*TrackError*) and the information ratio (*InfRatio*) of the funds compared to their benchmark, the natural logarithm of the years of the fund since inception (*Age*), the previous annual fund performance (*LagAlpha*), the natural logarithm of the total net assets managed by the fund (*Size*), and the annual net expense ratio (*Expenses*). Time dummies are considered in the last model. P-values (in parentheses) are from standard errors grouped by funds, and they are robust to heteroscedasticity, autocorrelation and temporal correlation.

variables on the turnover ratio, previous portfolio turnover and managers' remuneration still have a negative and statistically significant effect on the annualised risk-adjusted net returns obtained by fund investors.

Addressing the interdependence of the endogenous variables: A VAR approach.

In this section, we apply a vector autoregressive (VAR) model to establish the causality between the portfolio turnover, managers' remuneration and mutual fund performance. These variables are assumed to affect each other, and the VAR model allows us to document the interdependence among them. Therefore, they are considered as endogenous variables, while the age and size of

the funds are included as exogenous variables in the following model:

$$Y_t = a_0 + \sum_{j=1}^J A_j Y_{t-j} + B X_t + u_t \quad (2)$$

where Y_t is a vector that includes the endogenous variables in the period t ; X_t is a vector containing the exogenous variables in the same period; and u_t is the residual vector of the model. As indicated by the lag selection criteria, four lags are considered for the endogenous variables.

Results are shown in Table 6. The main coefficients and the t-statistic for each endogenous variable are reported. On the one hand, the evidence in Table 6 is in line with the aforementioned results. Firstly, the turnover ratio is highly autocorrelated. As shown in the table, the first-lag turnover has a statistically significant coefficient of 0.6219. Moreover, the fund performance is affected negatively by the previous turnover ratio (coefficient of -0.0078 for the first lag) and by managers' remuneration (coefficient of -0.4510 for the first lag), both of which are statistically significant (t-statistics of -7.06 and -5.35 , respectively). On the other hand, the coefficients of the previous performance on managers' remuneration are positive and statistically significant. This implies that their remuneration directly depends on the results achieved in the portfolio, which allows the interests of managers and investors to be aligned, reducing the potential agency problems that arise in mutual fund management.

Table 6. Vector autoregressive (VAR) model.

	Turnover	Remuneration	Alpha
Lag1Turnover	0.6219*** (70.07)	-0.0004^{***} (-3.67)	-0.0078^{***} (-7.06)
Lag2Turnover	0.0951*** (9.31)	0.0005*** (4.03)	0.0043*** (3.36)
Lag3Turnover	0.0272*** (2.71)	0.0000 (-0.42)	-0.0013 (-1.08)
Lag4Turnover	0.0897*** (11.13)	0.0003*** (2.98)	-0.0007 (-0.70)
Lag1Remuneration	-0.9274 (-1.37)	0.6471*** (82.07)	-0.4510^{***} (-5.35)
Lag2Remuneration	1.1571* (1.82)	0.0753*** (10.22)	-0.3830^{***} (-4.86)
Lag3Remuneration	1.1635** (2.26)	0.0271*** (4.53)	0.0021 (0.03)
Lag4Remuneration	-0.1909 (-0.46)	-0.0008 (-0.18)	0.1408*** (2.76)
Lag1Alpha	-0.0199 (-0.28)	0.0099*** (11.80)	-0.1032^{***} (-11.54)
Lag2Alpha	-0.0292 (-0.44)	0.0054*** (6.96)	-0.1033^{***} (-12.56)
Lag3Alpha	0.0875 (1.34)	0.0066*** (8.78)	0.0667*** (8.26)
Lag4Alpha	-0.0235 (-0.39)	0.0016** (2.30)	-0.0157^{**} (-2.07)
Size	-2.0477^{***} (-4.86)	0.2392*** (48.91)	0.8543*** (16.34)
Age	-0.2653 (-0.26)	-0.2372^{***} (-20.03)	-0.9515^{***} (-7.52)
Constant	31.7920*** (6.49)	-0.3884^{***} (-6.83)	-5.1959^{***} (-8.55)
R ²	0.739	0.919	0.066

Notes: This table shows the coefficients of a vector autoregressive model with four lags on the endogenous variables. *Turnover* (turnover ratio), *Remuneration* (natural logarithm of the managers' annual remuneration) and *Alpha* (performance of the mutual funds, measured as the intercept of the four-factor model) are considered as endogenous variables. *Size* (natural logarithm of the total net assets) and *Age* (natural logarithm of the years of the fund since inception) are considered as exogenous variables. T-statistics are shown in parentheses. *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively.

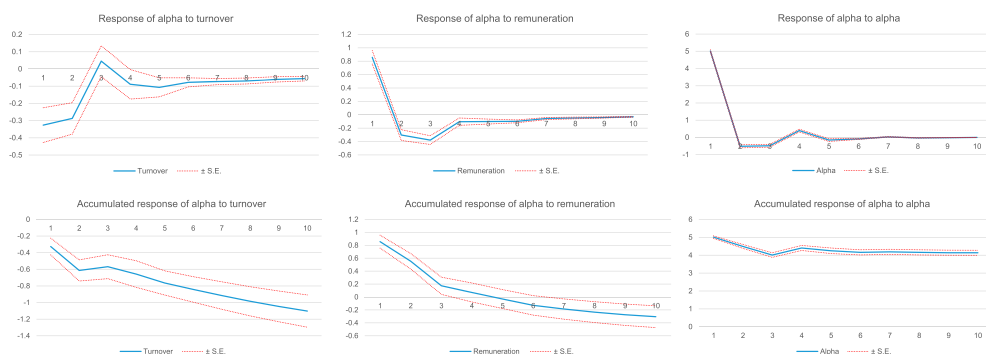


Figure 1. Impulse response function.

Notes: These figures show the response over time periods of the mutual fund performance (*Alpha*), measured as the intercept of the four-factor model, to shocks in *Turnover* (turnover ratio), *Remuneration* (natural logarithm of the managers' remuneration) and *Alpha*. *Size* and *Expenses* are considered as exogenous variables.

Finally, the impulse response function (IRF) related to this model indicates the impact of a positive change (or shock) in the explanatory variable (impulse variable) on the dependent variable (response variable) over the following periods. Figure 1 plots the results for the responses (Figure 1a) and the cumulative responses (Figure 1b) of the mutual fund performance when a shock is generated to the variables that are considered endogenous in the model.

Figure 1 shows that the effect of one-unit positive shock in the turnover leads to a drop in the mutual fund performance, accumulating -1.10% after ten years (Figure 1b). This effect is more relevant during the first two periods, when the alpha responds with a decrease of -0.33% and -0.29% , respectively (Figure 1a). Similarly, the negative response of the performance due to a shock of the same magnitude in the managers' remuneration is more pronounced over the second and third sub-periods (responses of -0.30% and -0.38%), and decreases after the fourth year.

Conclusions

In this study, we consider the fund turnover ratio as a good proxy to observe trading activity in mutual fund management, assuming that a higher level of this characteristic implies that fund managers reach higher levels of purchases and sales. A high turnover ratio can be motivated by managers' efforts to increase their added value to the fund portfolio, but involving high trading costs at the same time. As the information on this ratio is reported in the fund prospectus, it is reviewed by investors, and thus directly affects their investment decisions. Then, analysing the relationship between turnover and performance may be of interest to evaluate whether a strategy based on this ratio leads to better net results for investors.

In contrast with the previous literature, this study aims to analyse this relationship from the investor's perspective. Investors do not know *a priori* the specific portfolio turnover ratio reached in the mutual fund management. In light of the evidence from this study, they can use the information reported in the prospectus as a proxy of the level of portfolio turnover during the following year.

Our results suggest that a strategy based on investing in high-turnover funds does not provide investors with better risk-adjusted returns than investing in funds with low levels of portfolio turnover. Therefore, rational investors aiming to enhance their results should pay attention to this characteristic when selecting funds to invest in, otherwise their risk-adjusted net returns could deteriorate.

Notes

1. Lavin and Magner (2014) prove that turnover ratio measured on a monthly basis is persistent up to three months.

2. We also ran the Fama-French (1993) three-factor model, which leads us to similar conclusions. Results are therefore not reported for the sake of brevity.
3. Since turnover is calculated yearly, and since the level of portfolio turnover is not the same during a whole year as during a month, each year we remove all the observations that are susceptible to data error. Specifically, for each year we remove funds that do not have at least 230 daily data on return, or that do not present data on the fund characteristics, due to the impossibility of consistent analysis.
4. Amihud and Goyenko (2013) sort their portfolios on funds' lagged R^2 , and on lagged alpha.

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