Received 6 January 2017
Revised 5 June 2017
9 September 2017
2 October 2017
Accepted 6 October 2017

Portfolio turnover activity and mutual fund performance

Claudia Champagne
Department of Finance, Sherbrooke University, Sherbrooke, Canada
Aymen Karoui
Department of International Studies, York University, Toronto, Canada, and
Saurin Patel
University of Western Ontario, London, Canada

Abstract

Purpose – The purpose of this paper is to propose a new measure of portfolio activity, the modified turnover (MT), which represents the portion of the portfolio that the manager changes from one quarter to the next. Compared with the traditional turnover, the MT measure has a distinct interpretation, relies on portfolio holdings, includes the effects of flows and ignores the effects of offsetting trades.
Design/methodology/approach – Using quarterly holdings data, the authors examine the relationship between fund turnover, performance, and flows for a sample of 2,856 actively managed mutual funds over the period 1991-2012. The authors provide numerical examples to illustrate how the suggested measure, MT, is different from the traditional turnover measure. The authors use panel regressions, simple and double sorts to examine the predictability of performance.
Findings – The authors find evidence that high MT predicts lower performance. The comparison between the highest and lowest quintiles sorted based on MT reveals a difference of −2.41 percent in the annual risk-adjusted return. Furthermore, high MT predicts lower net flows. The authors also find that MT relates positively to other activeness measures while volatility, flows, size, number of stocks, and the expense ratio are significant determinants of MT. Overall, the results suggest that frequent churning of a portfolio is value destroying for investors and signals a manager's lack of skill.
Originality/value – The authors offer a simple measure, namely, MT, for estimating the fraction of a portfolio that changes from one quarter to the next. Armed with this tool, the authors investigate whether funds deviate from their previous quarter's holdings because of valuable or noisy information, and whether such signals are exploited by fund investors.

Keywords Performance, Turnover, Mutual funds, Flows, Modified turnover
Paper type Research paper

1. Introduction

For over three decades, researchers have examined the relation between mutual fund trading and fund performance. Some studies argue that mutual fund trading improves performance because managers are able to identify valuable investment opportunities (see e.g. Grinblatt and Titman, 1989; Chen *et al.*, 2000; Alexander *et al.*, 2007; Pastor *et al.*, 2016). Other studies argue that fund trading hurts performance because managers trade on noisy information (see e.g. Elton *et al.*, 1993; Carhart, 1997; Edelen *et al.*, 2013). Overall, the empirical evidence on whether fund trading improves or worsens future performance is mixed[1]. One of the main reasons behind this ambiguity is the way mutual fund trading is measured.

We argue that fund's trading activity can be gauged in two different ways. A straightforward approach is to aggregate the dollar amounts of trades made by a portfolio manager. This dimension is captured, for example, by the portfolio turnover ratio

The authors would like to thank Don T. Johnson (Editor), David Diltz (Guest Editor), David Rakowski (Co-Guest Editor), an anonymous referee, Yi Li, Viktoriya Lantushenko, Will Armstrong and participants at the Midwest Finance Association Meeting (Atlanta, 2016), Eastern Finance Association Meeting (Baltimore, 2016), and Financial Management Association Meeting (Las Vegas, 2016) for helpful comments.

Managerial Finance
Vol. 44 No. 3, 2018
pp. 326-356
© Emerald Publishing Limited
0307-4358
DOI 10.1108/MF-01-2017-0003

(PTR). A second approach, however, is to assess trading activity in terms of portfolio weight changes. Indeed, in some cases, portfolio managers may focus their trading on a small portion of the portfolio, which may not result in a dramatic churn of the portfolio. Our suggested measure, modified turnover (MT), aims to capture such dimensions, that is, the consequences of rebalancing activity in terms of portfolio weight changes.

While capturing distinct dimensions, PTR and MT are both, however, measures of active management. Indeed, MT tracks all changes in portfolio weights made by the portfolio manager(s) due to active investment strategy over a previous period as it compares the current portfolio weights to the weights of a hypothetical buy-and-hold portfolio based on previously disclosed fund holdings[2,3]. Likewise, PTR tracks trades made by the portfolio manager. For both measures, passive mechanical weight changes due to changes in stock prices are disregarded. It comes then as no surprise that the two measures should be positively correlated. Furthermore, we must acknowledge that when it comes to reflecting intra-quarter trading fluctuations both MT and PTR suffer from the same limitation. Because both these measures are calculated at a discrete frequency (quarterly for MT and annual for PTR), one cannot track intra-period trading activity (e.g., identify if there was more trading at the beginning or end of period).

Beyond the conceptual distinction, MT and PTR display several practical differences[4]. First, MT uses portfolio holding data while PTR calculation requires data on all trades made during a given time period. The second difference relates to the inclusion of fund flows. PTR, as suggested by the Securities and Exchange Commission, aims to measure rebalancing activity that does not involve current inflows or outflows. In a sense, it captures the replacement of existing assets only. MT, however, includes the effects of fund flows as it compares the starting portfolio to the next-period portfolio which includes fund flows. The effects of flows could, nonetheless, either increase or decrease the difference of weights with the starting portfolio[5]. The third difference between PTR and MT arises because of offsetting trades. PTR considers cumulative trades even when they yield offsetting positions. So when the same stock is bought and sold, both trades will be added up to give the total amount of buys and sells, respectively. However, MT considers those trades only when portfolio weights effectively change. The last difference pertains to the practical interpretation of the measures. MT is interpreted as the fraction of the portfolio that the manager has changed from the previously reported portfolio. By construction, MT ranges from 0 to 100 percent, where 0 percent implies that current portfolio weights have remained unchanged from the previous period and 100 percent implies the portfolio manager has changed the weights completely (i.e. no overlap between the starting and ending portfolios). PTR, however, is the ratio of trades to the average total net assets and tells the fraction of money (relative to the size of the portfolio) involved in the rebalancing activity. A PTR of 100 percent implies that the amount of aggregated trades equals the value of the portfolio but tells little about the distribution and magnitude of weight changes among portfolio holdings.

Our MT measure extends other holding-based turnover measures suggested by Gaspar *et al.* (2005) and Yan and Zhang (2009). These studies offer a holding-based turnover measure (known as portfolio churn rate) that captures how frequently a fund manager rotates her positions in the stocks of her portfolio. However, the two studies have addressed a completely different research question as they examine how portfolio turnover impacts stock returns rather than fund returns.

We begin our empirical analysis by focusing on the cross-sectional relation between MT and future fund performance. If managers hold valuable information, they are likely to trade more to target profitable investments. This argument concurs with a positive turnover-performance relation. On the other hand, fund managers may trade frequently simply based on noise, or without any rationale. In this case, the relation between turnover and performance will be weak or negative. Using quarterly portfolio holdings data for 2,856 diversified equity funds from 1991 to 2012, we test whether MT predicts future fund performance. We find a negative relation between MT and future fund performance. Funds with high MT have lower future risk-adjusted returns. Specifically, the difference between the four-factor α of the high and low MT portfolios equals −2.41 percent ($t=-2.12$) per year net of fees. Similarly, if we consider the four-factor α of the same portfolios before deducting expenses, we get a return differential of 2.17 percent ($t=-1.91$). This negative relation is more pronounced for poorly performing funds, less expensive funds and large funds. These results are robust in predictive regressions even after controlling for active management and various fund characteristics. For the purpose of comparison, we perform the same analysis using a traditional PTR measure. We find that the four-factor α differential between the high and low quintile portfolios sorted by PTR equals −1.31 percent ($t=-1.56$) per year net of fees and −1.17 percent ($t=-1.39$) per year before fees. Overall, these results suggest that managers who frequently reshape their portfolios are not skilled and in fact are value destroying for investors.

Further, to understand how trading impacts performance, we distinguish between discretionary and forced trading in turnover activity. Involuntary flow movements may force managers to trade even when there are no profitable opportunities. To rule out this possibility, we run a test similar to Lou (2012), whereby turnover is first regressed on flows and then used as an independent variable. Our empirical findings show that turnover still significantly predicts performance. Furthermore, we examine the turnover-performance relationship using a number of alternative definitions of the MT. First, we compute MT separately for new openings and existing positions and find that while both these measures are significant, MT based on new openings has higher impact on performance than existing positions. Second, we follow Yan and Zhang (2009) and use buys and sells to compute two different versions of MT. Both these versions of MT are highly significant, especially the sells version has a higher impact on performance than buys version. This is consistent with the idea that sells may occur in more difficult conditions than buys and so are likely to further damage the portfolio performance.

Further, given that MT predicts short-term (i.e. three month) future fund performance, it is natural to ask whether MT predicts long-term performance as well. The question is of primary importance as it has remained largely unaddressed by the literature. Consistent with the short-term results, we find that the difference in the risk-adjusted performance of the high- and low-MT portfolios is negative for horizons ranging from six months up to five years.

In a recent study, Pastor *et al.* (2016) find a positive and significant relationship between fund turnover and performance. One major difference between their study and ours is that their focus is on the time-series relationship while our focus is on the cross-sectional relationship between turnover and performance. Furthermore, the authors state that "overconfidence can thus in principle induce even a negative cross-sectional turnover-performance relation" (p. 9). The negative relationship in our findings is thus in line with this intuition and can be attributed to lack of skill as well as to overconfidence. Moreover, when we use fund fixed effects in the regression setting, we find no statistically significant relationship between MT and performance. This further supports the cross-sectional nature of the MT-performance relationship.

We also examine the determinants of MT. Not surprisingly, we find that PTR is an important determinant of MT. PTR explains 39 percent of the variation in MT over the sample. This clearly suggests that despite some overlap between both measures, MT captures a dimension that is clearly distinct from PTR. Looking at the other fund characteristics, we find that return volatility, flows, fund size, number of stocks held and expense ratio are related to MT. Also worthy of mention is that, altogether, fund characteristics (excluding PTR) explain weight changes only up to 7.3 percent, as estimated by R^2. Thus, trading activity is not merely a response to fund characteristics like past performance or flows; it also reflects a portfolio manager's efforts to generate profits, as defended by Alexander *et al.* (2007).

Now we turn to the relation between MT and other activeness measures. Even though, by construction, MT is related to activeness measures, the nature of information captured by these measures is quite different. While MT captures time-series variations in a fund's portfolio weights over the previous quarter, commonly used activeness measures such as Active Share (AS) (Cremers and Petajisto, 2009), R^2 (Amihud and Goyenko, 2013), Active Weight (AW) (Doshi *et al.*, 2015), Industry Concentration Index (ICI) (Kacperczyk *et al.*, 2005) and Return Gap (RG) (Kacperczyk *et al.*, 2008) capture cross-sectional variations among funds with respect to either an equity index or a theoretical market weight portfolio in the same quarter[6]. The informational difference is also evident from the low correlations between MT and these activeness measures (AS (0.13), AW (0.02), R^2 (−0.06), ICI (0.06), and RG (0.05)). However, to account for any potential impact of activeness on MT, we double sort MT with various activeness measures. We find that a negative MT-performance relation is less pronounced for more active funds[7]. This result is consistent with the aforementioned papers which argue that more active funds display more skill. For robustness, we also control for these activeness measures in all our predictive regressions and find little impact. Overall, these results suggest that MT is distinct from existing activeness measures and that it provides useful complementary information by capturing deviations from a hypothetical buy-and-hold portfolio based on disclosed holdings of the previous period.

Next, we look at whether MT affects a fund's future flows. Specifically, we test whether mutual fund investors adjust their flows with respect to MT. We investigate this because the empirical evidence from extant studies on turnover-flow relation is inconclusive. For example, Rakowski and Wang (2009) document a positive relation between turnover and flows whereas Sapp and Tiwari (2005) find no relation. Agarwal *et al.* (2014) document a negative relation between fund turnover and fund flows. However, they also argue that investors rely on holdings-based measures to assess managerial ability, and that "capital flows from investors should respond to portfolio holding characteristics after controlling for past performance" (p. 19). So, a positive relation between future flows and MT suggests that investors perceive managers as skilled and their portfolio changes as value-enhancing, while a negative relation implies that managers are unskilled and their trades are seen as value destroying. Our empirical results show a negative relation between MT and next-quarter flows. This indicates that investors are able to identify *ex ante*, unskilled frequent trading from skilled infrequent trading and that they are likely to adjust their flows accordingly.

Our study makes several contributions to the literature. First, it offers a new and simple- to-compute measure of mutual fund turnover that tracks weight changes made by a portfolio manager. This is a significant innovation as existing measures focus solely on manager trading intensity while disregarding how trading decisions ultimately affect portfolio weights. Second, the paper presents new evidence on whether mutual fund trading reflects managerial skill and managers' ability to generate positive future fund performance. We find that managers who frequently churn their portfolios underperform both in the short-term and long-term compared to managers who change their portfolios less frequently. Our results are robust to alternative measures of performance, and inclusion of various fund characteristics and activeness measures. Finally, the paper also contributes to our understanding of investment behavior of mutual fund investors. It provides important insights into how investors' change their investment behavior after observing frequent portfolio trading. The fund flow patterns show that investors are able to both identify, *ex ante*, and avoid investing in mutual funds that trade too often. Overall, our study sheds new light on the impact of trading on fund performance and how investors react to such trading activity.

2. Data and variable description

2.1 Sample selection

Our primary mutual fund data sources are the CRSP mutual fund database and the Thomson Financial CDA/Spectrum mutual fund database. We select US equity mutual funds based on the Lipper style classifications and exclude index funds, international funds, balanced funds, and sector funds. We extract monthly fund net returns, annual turnover (PTR) and annual expense ratios, the number of stocks in each portfolio, investment objectives, and total net assets. To avoid double-counting due to different share classes of the same fund, total net assets are summed up, while monthly returns, the expense ratio, and turnover are value-weighted at the fund portfolio level. Fund portfolio holdings are extracted from the Thomson Financial database at a quarterly frequency. We merge the data from the CRSP and Thomson Financial databases using MFLINKS files. Our sample comprises 2,856 unique funds and covers the period of 1991-2012. The style categorization relies on the following CRSP variables: Strategic Insight Objective Codes, Lipper Classifications, Wiescat Codes, and Wiesenberger Codes. Funds are then assigned into one of the following seven style categories: aggressive growth, mid cap, small cap, growth and income, growth, equity income, and maximum capital gains. Monthly stock returns and prices are extracted from the CRSP stock database and merged into fund holdings using the CUSIP as a common identifier. Fama and French (1993) and momentum factors are from Kenneth French's website. We eliminate funds that have less than $15 million of assets under management or less than ten stocks in their portfolios. Consistent with Cremers and Petajisto (2009), we require that the average equity portion of the portfolio accounts for at least 80 percent of the fund's total net assets during the examined period.

2.2 MT and flow measures

We suggest assessing portfolio activity using the MT measure, which equals half of the sum of the absolute differences between the quarter t weights of the actual and buy-and-hold portfolios, as shown in the following equations:

$$\text{Modified turnover}_{j,t} = \frac{1}{2}\sum_{i=1}^{N_j} \left|\omega_{i,t}^{\text{observed}} - \omega_{i,t}^{\text{BH}}\right| \tag{1}$$

$$\omega_{i,t}^{\text{BH}} = \omega_{i,t-1}^{\text{observed}} \left(\frac{1+R_{i,t}}{1+R_{j,t}^{\text{BH}}}\right) \tag{2}$$

where $\omega_{i,t}^{\text{observed}}$ is the weight of stock i as reported in jth fund holdings at quarter-end t; $\omega_{i,t}^{\text{BH}}$ the buy-and-hold weight of stock i at quarter-end t (using quarter-end $t-1$ weights as starting weights); N_j the total number of distinct stocks held either at the end of quarter $t-1$ and at the end of quarter t by fund j[8]; and $R_{i,t}$ the return of stock i in quarter t, and $R_{j,t}^{\text{BH}}$ is the buy-and-hold portfolio return of fund j in quarter t and is computed using the following equation:

$$R_{j,t}^{\text{BH}} = \sum_{i=1}^{N_j} \omega_{i,t-1}^{\text{observed}} R_{i,t} \tag{3}$$

where $\omega_{i,t-1}^{\text{observed}}$ is the weight of stock i as reported in the jth fund holdings at quarter-end $t-1$ and $R_{i,t}$ is as defined for Equation (2). Equation (1) includes a multiplication by 0.5 in order to restrict the range of the MT to between 0 and 1.

MT compares actual portfolio weights to buy-and-hold portfolio weights during a given period. By capturing these changes in portfolio weights, MT reflects the active changes made by the fund manager as opposed to mechanical changes due to stock price fluctuations. MT can be intuitively interpreted in the following manner. Passively managed funds that seldom change their portfolio holdings between quarters $t-1$ and t will have an MT measure close to 0. Similarly, actively managed funds that completely change their portfolio holdings from quarter $t-1$ to t will have MT measure close to 1.

Finally, quarterly fund flows are computed using the following equation:

$$\text{flows}_{j,t} = \frac{\text{TNA}_{j,t} - \text{TNA}_{j,t-1}\left(1+R_{j,t}\right)}{\text{TNA}_{j,t-1}}, \tag{4}$$

where $\text{TNA}_{j,t}$ and $\text{TNA}_{j,t-1}$ are the total net assets for fund j in quarters t and $t-1$, respectively, and $R_{j,t}$ is the cumulative return of the jth fund in quarter t.

2.3 Activeness measures

The mutual fund literature documents a strong relation between activeness measures and future fund performance. To make sure our results are robust to these activeness measures, we include five activeness measures in our analyses. These include ICI, AS, AW, R^2, and RG[9].

2.4 Descriptive statistics and determinants of MT

Panel A of Table I reports descriptive statistics for different turnover and activeness measures used in our estimations: MT, PTR, ICI, AS, AW, R^2, and RG. The table shows that the mean (median) MT of the fund portfolios is equal to 22.40 percent (19.17 percent), while the mean (median) PTR equals 85.20 percent (66.26 percent). MT and AS are two quarterly measures that show the highest cross-sectional dispersion as measured by standard deviation. Panel A also includes descriptive statistics for some fund characteristics such as past 12 month returns, volatility of 12 months returns, net fund flows, TNA, number of stocks, expense ratio, and fund age. The average cumulative one-year return is equal to 10.36 percent while average volatility is equal to 16.62 percent.

Panel B of Table I displays descriptive statistics for our set of variables sorted by MT quartiles. Each quarter, all funds are assigned to one of four quartiles according to their MT rank, and then average characteristics of each of these portfolios are computed. We repeat the same estimation for all the sample quarters and then display the averages of these computations in Panel B of Table I. PTR, AS and annual RG increases monotonically with MT. Among the fund characteristics, volatility, flows, and expense ratio increase monotonically with MT, while TNA relates negatively to MT.

Table II shows the correlation matrix for our variables. MT is correlated with PTR at 63 percent, ICI at 6 percent, AS at 13 percent, AW at 2 percent, R^2 at −6 percent, and RG at 5 percent. Thus, except for PTR, none of the mentioned activeness dimensions overlap greatly with MT. Furthermore, fund return volatility correlates with MT at 24 percent and positively correlates with most activeness measures. Compared with PTR, MT strongly correlates with return volatility and TNA and weakly correlates with the number of stocks in the portfolio. Expense ratio positively correlates with both PTR and MT, indicating that a high level of portfolio trading goes along with high trading costs.

Next, we investigate the determinants of MT. A number of fund characteristics may affect a manager's decision to change portfolio weights. First, we consider the group of activeness measures (ICI, AS, AW, R^2, and RG) and verify how MT relates to each of these variables. Even though these measures capture various features of activeness, we anticipate that they will correlate positively with MT. Second, because of the importance of performance and fund inflows for portfolio managers and investors, we wish to know whether these variables are determinants of portfolio activity. While changing weights can potentially affect performance, it is also possible for performance to affect portfolio activity. Do better-performing managers tend to alter their portfolios more dramatically than weaker-performing managers? Following the recent observations from the mutual fund tournament literature (e.g. Chen and Pennacchi, 2009; Cullen *et al.*, 2012), we anticipate that better-performing managers will be more passive in their management, thus reducing their portfolios' MT, at least in the short term. In terms of fund flows, fund managers that receive

Table I. Descriptive statistics for modified turnover and other fund characteristics

Panel A: descriptive statistics of activeness measures and fund characteristics

Variable	Frequency	*n*	Mean	Median	SD	Min.	Max.	P10	P90
Activeness measures									
Modified turnover	Q	55,609	0.2240	0.1917	0.1302	0.0469	0.8188	0.0951	0.3981
Turnover	A	29,262	0.8520	0.6626	0.7257	0.0106	5.5991	0.1864	1.7240
Industry concentration index	Q	80,246	0.0545	0.0414	0.0485	0.0024	0.3760	0.0110	0.1117
Active Share	Q	62,673	0.8131	0.8377	0.1376	0.3677	0.9992	0.6167	0.9706
Active Weight	Q	79,965	0.4015	0.3936	0.1001	0.1681	0.6989	0.2772	0.5373
R^2	M	318,649	0.9066	0.9213	0.0612	0.6063	0.9900	0.8279	0.9665
Annual Return Gap	M	220,646	−0.0021	−0.0030	0.0378	−0.1705	0.1640	−0.0429	0.0399
Fund characteristics									
Return_12m	M	356,485	0.1036	0.0969	0.0998	−0.3249	0.5821	−0.0106	0.2285
Volatility_12m	M	356,485	0.1662	0.1570	0.0459	0.0560	0.4162	0.1187	0.2281
Flows	Q	99,966	−0.0113	−0.0191	0.0762	−0.1521	0.3313	−0.0755	0.0579
Flow_volatility12m	M	351,889	0.2428	0.0916	0.6669	0.0080	9.6532	0.0305	0.4170
TNA (in $M)	Q	108,308	406.8590	145.9572	885.1867	30.3956	7,469.5704	37.3676	997.7020
Number of stocks	Q	79,987	98.3606	72.7556	88.4103	18.4778	763.3000	35.5833	182.4222
Expense ratio	A	31,082	0.0127	0.0124	0.0049	0.0001	0.0361	0.0071	0.0189
Fund age, years	M	383,719	9.5692	7.1576	8.5811	0.3838	54.9959	2.2047	19.9178

Panel B: activeness measures and fund characteristics sorted by modified turnover

Quartiles	Q1	Q2	Q3	Q4	Q4-Q1
Activeness measures					
Modified turnover	0.0966	0.1587	0.2311	0.4066	0.3100***
Turnover	0.3414	0.5632	0.8642	1.5016	1.1602***
Industry concentration index	0.0526	0.0512	0.0505	0.0578	0.0052***
Active Share	0.7961	0.8161	0.8196	0.8408	0.0447***
Active Weight	0.4036	0.3971	0.3928	0.4016	−0.0019
R^2	0.9041	0.9117	0.9130	0.9025	−0.0016
Annual Return Gap	−0.0062	−0.0039	−0.0009	−0.0001	0.0060***

(*continued*)

Fund characteristics					
Return_12m	0.1069	0.1090	0.1109	0.1106	0.0036
Volatility_12m	0.1490	0.1607	0.1703	0.1810	0.0320***
Flows	0.0152	0.0192	0.0240	0.0277	0.0125***
Flow_volatility12m	0.1714	0.1903	0.1921	0.2284	0.0570***
TNA (in $M)	981.5330	867.0496	704.7462	524.8466	−456.6863***
Number of stocks	89.9428	101.4684	107.6133	99.9283	9.9854***
Expense ratio	0.0119	0.0123	0.0130	0.0139	0.0019***
Fund age, years	11.9698	12.3193	11.4795	10.5587	−1.4111***

Notes: Panel A of Table I reports descriptive statistics (frequency, number of observations (*n*), mean, median, standard deviation, minimum, maximum, 10th and 90th percentiles) for our set of variables: modified turnover, turnover, industry concentration index (ICI), Active Share (AS), Active Weight (AW), R^2 of Amihud and Goyenko (2013), the Return Gap, return_12m, volatility_12m, flows, flow_volatility_12m, total net assets (TNA) in millions of $, number of stocks, expense ratio, and fund age in years. All the statistics are first computed at a monthly frequency and then averaged across all months. All the variables are winsorized at 0.5 and 99.5 percent percentiles. In Panel B, funds are sorted, each quarter, into quartiles based on modified turnover and then the average characteristics of each quartile are computed. All these statistics are then averaged across all quarters. The last column reports the difference between quartiles 4 and 1. *,**,***Significant at 10, 5 and 1 percent levels, respectively

Table I.

Table II. Correlation matrix for modified turnover and other fund characteristics

	MT	PTR	ICI	AS	AW	R^2	Return Gap	Return 12m	Volatility 12m	Flows	Flow_volatility12m	TNA	Number stocks	Expense ratio	Fund age
Modified turnover	1.00														
Turnover	0.63***	1.00													
ICI	0.06***	0.05***	1.00												
Active Share	0.13***	0.06***	0.42***	1.00											
Active Weight	0.02***	0.03***	0.13***	0.17***	1.00										
R^2	−0.06***	−0.13***	−0.35***	−0.45***	−0.18***	1.00									
Return Gap	0.05***	0.04***	0.02**	0.07***	−0.01	0.02***	1.00								
Return_12m	−0.02	−0.02	0.04*	0.08***	−0.01	−0.01	0.11***	1.00							
Volatility_12m	0.24***	0.22***	0.35***	0.35***	−0.07***	−0.06***	0.12***	0.01	1.00						
Flows	0.02*	−0.04**	0.01	0.02*	0.01	−0.07*	0.12***	0.19***	−0.02	1.00					
Flow_volatility12m	0.07***	0.05***	0.02***	0.01	−0.01**	−0.04***	0.01	0.03***	0.02***	−0.06	1.00				
TNA	−0.10***	−0.07***	−0.01**	−0.12***	0.01***	0.06*	0.00	0.02	−0.01	0.05	−0.15***	1.00			
Number of stocks	0.02***	0.05***	−0.20***	−0.26***	−0.07***	0.27***	0.01	0.03***	0.02**	0.01***	−0.03***	0.18***	1.00		
Expense ratio	0.16***	0.17***	0.15***	0.21***	0.08***	−0.23***	0.03***	−0.05***	0.16***	0.00	−0.01	−0.16***	−0.12***	1.00	
Fund age	−0.07***	−0.04***	0.00	−0.03***	0.04***	0.06***	−0.03***	−0.01***	0.01***	−0.09***	−0.13***	0 .31***	0.06***	−0.08***	1.00

Notes: Table II reports the Pearson correlation coefficients for our set of variables: modified turnover, turnover (PTR), industry concentration index (ICI), Active Share (AS), Active Weight (AW), the R^2 of Amihud and Goyenko (2013), Return Gap, return_12m, volatility_12m, flows, flow_volatility_12m, total net assets (TNA) in millions of $, number of stocks, expense ratio, and fund age in years. All the correlations are computed cross-sectionally for each month and then averaged across all months. *,**,***Significant at 10, 5 and 1 percent levels, respectively high inflows can allocate money across the various stocks held in their portfolios. They can allocate the new inflows in a "neutral way" without changing the relative weights of the stocks within the portfolio, or they can deviate from this allocation. Doing the latter is likely to modify the allocation of the fund, thereby increasing the fund's MT.

To identify the determinants that affect MT, we run a regression of MT on performance and flows, as well as on common fund characteristics identified in the literature, such as volatility and the expense ratio. The following equation is used[10]:

$$\begin{aligned} \mathrm{MT}_{j,t} = {} & a_0 + a_1\,\mathrm{PTR}_{j,t} + a_2\,\mathrm{ICI}_{j,t} + a_3\mathrm{Active\ Share}_{j,t} + a_4\,\mathrm{Active\ Weight}_{j,t} \\ & + a_5\,R^2_{j,t} + a_6\,\mathrm{Return\ Gap}_{j,t} + a_7\,\mathrm{return\_12m}_{j,t} \\ & + a_8\,\mathrm{volatility\_12m}_{j,t} + a_9\,\mathrm{flows}_{j,t} + a_{10}\,\mathrm{flows}_{j,t-1} \\ & + a_{11}\,\mathrm{flow\_volatility\_12m}_{j,t-1} + a_{12}\ln\left(\mathrm{TNA}_{j,t}\right) + a_{13}\ln\left(\mathrm{number\ of\ stocks}_{j,t}\right) \\ & + a_{14}\,\mathrm{expense\ ratio}_{j,t} + a_{15}\,\mathrm{fund\ age}_{j,t} + \sum_{s=1}^{7} b_s\mathrm{style\ dummy}_{j,s,t} + \varepsilon_{j,t} \end{aligned} \tag{5}$$

where $\mathrm{MT}_{j,t}$ is defined as in Equation (1). The independent variables are defined in Table AI. The regression for Equation (5) is run using fund-clustered standard deviations and quarter dummy variables.

Table III shows the results of the regression of Equation (5). Columns (1) shows that PTR significantly and positively relates to MT with a coefficient of 0.128, which implies that a change of 10 percent (per year) in turnover affects MT by almost 1.28 percent per quarter

Modified turnover	1	2	3
Activeness measures			
Turnover	0.128*** (53.46)		0.126*** (50.36)
ICI	0.046** (2.10)		0.023 (1.07)
Active Share	0.018* (1.96)		0.037*** (3.36)
Active Weight	0.055*** (4.90)		0.027** (2.27)
R^2	0.029** (2.02)		−0.023 (−1.45)
Annual Return Gap	0.026 (1.06)		−0.035 (−1.40)
Fund characteristics			
Return_12m		−0.016*** (−3.85)	−0.004 (−1.04)
Volatility_12m		0.260*** (14.49)	0.126*** (11.84)
Flows		0.013** (1.96)	0.021*** (3.59)
Lag flows		0.010* (1.88)	0.009* (1.72)
Flow_Volatility_12m		0.003 (1.57)	−0.001 (−0.37)
LN(TNA)		−0.010*** (−7.33)	−0.002*** (−3.54)
LN(n_stocks)		0.021*** (6.51)	0.010*** (5.07)
Expense ratio		4.053*** (7.64)	0.733*** (2.97)
Fund age, years		−0.000 (−0.51)	0.000 (0.85)
Intercept	0.076*** (4.79)	0.088*** (4.85)	0.052** (2.57)
n	33,315	47,344	31,054
Adj. R^2	0.499	0.073	0.516

Notes: Table III reports the results of the quarterly panel regression of modified turnover on fund characteristics (as defined in Table II): turnover (PTR), industry concentration index (ICI), Active Share (AS), Active Weight (AW), R^2, annual Return Gap (RG), return_12m, volatility_12m, flows, lagged flows, flow_volatility_12m, logarithm of total net assets (TNA) in millions of \$, logarithm of number of stocks, expense ratio, and fund age. The regressions in columns 1-8 include time (year) and style dummies. Standard deviations are clustered by fund for all columns. *,**,***Significant at 10, 5 and 1 percent levels, respectively

Table III. Determinants of modified turnover (or about 5.12 percent per year). While it is an important variable turnover does not, however, entirely overlap with MT and yields a regression R^2 equal to 49.9 percent when including the explanatory power of other activeness measures. Furthermore, column (1) shows that MT is positively linked with all of the activeness measures considered, thereby confirming its affiliation to the family of activeness measures. When all the activeness measures and fund characteristics are included in the same regression, as in column (3), PTR, AS, AW, and R^2 have a significant effect on MT.

Column (2) in Table III indicates that a fund's MT negatively relates to 12-month returns. This indicates that better-performing managers do not alter their portfolios as often as poorly performing managers. The results also show that contemporaneous and lagged fund flows load positively on MT. Therefore, important and volatile flows seem to be associated with larger shifts in portfolio positions. Finally, high MT is associated with higher volatility, confirming that MT measures an activeness dimension of funds. A smaller amount of TNA, a larger number of stocks, and a higher expense ratio are all significantly related to a higher MT. Overall, the fund characteristics, while important, do not fully explain the MT measure. Thus, a large proportion of portfolio weight changes remain under the portfolio manager's control.

3. Methodology and empirical results

3.1 Predicting performance using MT

Chen *et al.* (2000) suggest two competing hypotheses in explaining the turnover-performance relation in funds. First, if managers hold better information and have the ability to target profitable investments, they are likely to trade more. Those with no information are, however, more reluctant to trade as frequently. This argument concurs with a positive turnover-performance relation. On the other hand, the second hypothesis suggests that some fund managers may trade frequently simply based on noise, or without any rationale. In this case, the relation between turnover and performance will be either weak or negative. In testing this hypothesis, we acknowledge that some fund managers may have valuable information but decide not to trade, as they already hold an optimal portfolio. While it is unlikely that actively managed funds intentionally maintain a low MT, we cannot rule out this possibility. The current section examines the impact of MT on short- and long-term performance.

3.1.1 Simple sort analysis. Each quarter, we sort funds into five quintiles based on MT. Then, we compute the TNA-weighted returns of these quintile portfolios over the next three months. Repeating this procedure across all quarters yields time series of monthly returns on each quintile portfolio. We next compute the returns of the high-minus-low portfolio which is the difference in returns between the top and bottom MT-sorted portfolios. After that, we use the Carhart four-factor model to compute the risk-adjusted α's over the full sample period for each portfolio:

$$R_{j,t}-R_{f,t} = a_0 + a_1\text{MKT}_t + a_2\text{HML}_t + a_3\text{SMB}_t + a_4\text{MOM}_t + \varepsilon_{j,t}, \tag{6}$$

where $R_{j,t}$ is portfolio j's net return in month t and $R_{f,t}$ is the T-bill rate in month t. MKT, HML, SMB, and MOM are the market, value, size, and momentum factors, respectively. The α parameter α_0, denotes the risk-adjusted performance of portfolio j. We also compute the risk-adjusted returns of Equation (6) using monthly gross returns. The latter are equal to the monthly net returns plus the annual expense ratio divided by 12.

Table IV shows the results of a simple sort analysis. The net risk-adjusted returns (in percentages and per year), as measured by Carhart α's, monotonically decrease as MT increases, thereby supporting the negative relation between MT and next-period performance. Moreover, the difference in α's between the high and low MT-sorted

	Carhart α's			Unconditional loadings		
	Net	Gross	MKT	HML	SMB	MOM
Panel A: portfolios sorted by modified turnover						
MT portfolios						
Low	−0.42	0.55	0.97***	0.10***	−0.02	−0.04***
2	−0.95	0.05	1.00***	−0.01	0.11***	−0.01
3	−1.44**	−0.36	1.01***	−0.05**	0.19***	0.00
4	−1.78**	−0.62	1.05***	−0.10***	0.26***	0.04*
High	−2.82**	−1.62	1.04***	−0.13***	0.32***	0.13***
High-Low	−2.41**	−2.17*	0.07**	−0.23***	0.34***	0.16***
t-statistic	(−2.12)	(−1.91)	(2.35)	(−4.50)	(3.64)	(4.29)
Panel B: portfolios sorted by portfolio turnover ratio						
PTR portfolios						
Low	−0.57	0.40	0.97***	0.03**	0.07***	−0.04***
2	−0.93	0.08	1.00***	−0.05***	0.07***	−0.01
3	−1.08	0.04	1.02***	−0.09***	0.15***	0.03***
4	−1.97***	−0.85	1.06***	−0.13***	0.20***	0.06***
High	−1.88*	−0.76	1.05***	−0.10***	0.25***	0.12***
High-Low	−1.31	−1.17	0.08***	−0.13***	0.18***	0.16***
t-statistic	(−1.56)	(−1.39)	(4.24)	(−4.25)	(3.89)	(5.98)

Notes: Table IV displays risk-adjusted returns (annualized and in percentages) net and gross of fees, as well as the Carhart coefficients for fund quintiles sorted by modified turnover (MT) in Panel A and portfolio turnover ratio (PTR) in Panel B. Quintile 1 includes the funds with the smallest modified turnover and quintile 5 includes those with the largest. Each quarter, funds are assigned to one of five portfolios according to their modified turnover (traditional turnover, in Panel B) and then the fund's return over the next three months is saved. Next, we form the TNA-weighted returns of these portfolios and run monthly regressions of excess returns on the four Carhart factors using the full sample period. The bottom two rows display the difference in α's between the top and bottom quintiles and the (Newey-West) *t*-statistic for this difference. *,**,***Significant at 10, 5 and 1 percent levels, respectively

Table IV. Simple sorts on modified turnover

portfolios is negative and statistically significant. The difference amounts to −2.41 percent per year, with a *t*-statistic equal to −2.12. The results hold true when we consider gross returns: the difference in risk-adjusted returns between the high and low MT-sorted portfolios remains statistically significant, albeit slightly smaller in terms of magnitude. The difference is −2.17 percent per year, with a *t*-statistic equal to −1.91. Moreover, the risk-adjusted performances of all quintiles become statistically non-significant, which is in line with the mutual fund literature that defends statistically negative net performance and statistically insignificant gross performance.

MT can also be interpreted as roughly the inverse of the holding period. That is, a fund with a quarterly turnover of 25 percent will hold its stocks for approximately one year. Thus, short-term investors will have a higher MT. Our results will then be consistent with long-term investors outperforming short-term investors.

It is interesting to examine how MT relates to each of the Carhart coefficients. The right part of Table IV shows that the difference in market β between the highest and lowest MT-sorted portfolios is positive and statistically significant, indicating that high MT is related to a higher market β. In other words, high-turnover funds have higher systematic risk. Furthermore, the difference in the HML coefficient is negative and statistically significant, implying that high MT is related to investment in stocks with low book-to-market ratios (i.e. growth stocks). Also the difference in the SMB coefficient is positive and statistically significant, showing that higher MT is associated with funds that invest in small capitalizations. Finally, momentum strategies appear to be related to greater portfolio churning, as measured by MT. Overall, these results support the idea that portfolio churning is partly explained by cross-sectional variations in investment strategies and therefore the use of risk-adjusted performance measures is necessary.

Panel B of Table IV reports simple sort results of PTR. Several interesting findings emerge. First, similar to MT results, risk-adjusted return decreases as PTR increases. However, the magnitude and the significance of such a relation are lower. The difference in α's between the top and bottom PTR-sorted portfolios is equal to −1.31 percent (t-statistic = −1.56) and to −1.17 percent (t-statistic = −1.39) when we consider gross returns. Second, while PTR alone does not strongly predict performance, as a component of MT it may have a substantial contribution. Finally, a look at the Carhart factor loading coefficients reveals smaller differences in the HML and SMB coefficients compared to those previously found in the MT sort.

3.1.2 Double sort analysis. As shown in the correlation matrix in Table II, several activeness measures and fund characteristics interact with MT, which in turn may affect the MT-performance relationship. To control for simultaneous effects of fund characteristics and other activeness measures on fund performance, we proceed with independent double sorts by MT and each of the following fund characteristics: flows, return_12m, expense ratio, TNA, PTR, and flow_volatility_12m. Then, we sort funds by MT and each of the five activeness measures examined in this paper: ICI, AS, AW, R^2, and RG. We follow Huang *et al.* (2011) and each quarter funds are assigned into two groups according to a given fund characteristic and into five groups according to MT. We are able to obtain ten portfolios. Then, we compute the TNA-weighted returns of these portfolios for the following three months and regress the excess returns on the Carhart four factors. We also compute the high-minus-low portfolio returns and risk-adjusted returns[11].

Panel A of Table V reports the results of double sorts based on MT and fund characteristics. Sorting funds on flows shows that the difference in risk-adjusted returns between the top and bottom MT-sorted portfolios is negative in both the low- and high-flow groups. However, it is more significant for low-flow funds. This finding confirms our intuition that lower flows are likely to put greater pressure on managers to increase trading activity. Funds with low flows bear the costly outcome of their trading. However, as the difference remains negative for both groups, the effects of flows do not fully explain the MT-performance relation.

Sorts on the lagged one-year returns show that the results are more significant for poorly performing funds that are likely to suffer more from the negative consequences of trading. The same holds true for less expensive funds and large funds. The results for these two characteristics are also consistent with the explanations provided by Pastor *et al.* (2016), namely, that small and less expensive funds display less skill.

In contrast, double sorting funds based on PTR and MT clearly shows that MT borrows some of the predictive power of PTR, as the results are negative only for one group: the low-turnover funds. Thus, MT still relies on the information embedded in trading frequency as measured by the traditional turnover measure. It is then the joint effects of the two measures that fuel the predictability of performance. Finally, the sort on flow volatility shows that performance difference remains negative for the low-flow and high-flow volatility groups.

Panel B of Table V reports the results of the double sort based on MT and fund activeness measures. The double sort based on MT and ICI reveals that both in the low- and high-ICI groups, the difference between top and bottom MT-sorted portfolios is negative. This difference is larger and more significant in the low-ICI group. Furthermore, as the two high-minus-low differences are negative, the ICI factor does not fully explain the cross-sectional variance in MT. The sort on AS reveals a negative difference in the low and high active groups, but is more negative in the latter group. The opposite result is observed in the AW sorts. The sort based on R^2 reveals a negative and significant relation for both groups. Next, the sort using RG reveals a

Table V. Double sorts on modified turnover, activeness measures and fund characteristics

Panel A: funds are sorted by MT and fund characteristics

	Flows			1 Year prior return			Expense ratio		
MT portfolio	Low	High	H-L	Low	High	H-L	Low	High	H-L
Low	−0.46	−0.20	0.26	−0.92	−0.67	0.25	−0.11	−1.71**	−1.61**
	(−0.58)	(−0.26)	(0.30)	(−0.97)	(−0.87)	(0.22)	(−0.17)	(−2.23)	(−2.19)
2	−1.24*	−1.18	0.05	−0.94	−0.99	−0.05	−0.46	−1.36*	−0.90
	(−1.79)	(−1.42)	(0.07)	(−1.00)	(−1.09)	(−0.05)	(−0.67)	(−1.87)	(−1.35)
3	−1.01	−1.27	−0.26	−1.02	−1.98**	−0.98	−1.17*	−2.18**	−1.06
	(−1.01)	(−1.50)	(−0.24)	(−0.98)	(−2.15)	(−0.74)	(−1.67)	(−2.55)	(−1.27)
4	−0.63	−2.16***	−1.53*	−1.90*	−0.88	1.02	−1.50*	−1.68*	−0.18
	(−0.64)	(−2.68)	(−1.87)	(−1.73)	(−0.99)	(0.94)	(−1.86)	(−1.83)	(−0.25)
High	−3.13***	−2.05	1.08	−2.77**	−1.66	1.11	−2.99**	−3.19***	−0.20
	(−2.73)	(−1.51)	(1.13)	(−2.32)	(−1.26)	(0.78)	(−2.54)	(−2.71)	(−0.28)
H-L	−2.68**	−1.86		−1.85*	−0.99		−2.88**	−1.48	
t-stat.	(−2.33)	(−1.44)		(−1.85)	(−0.80)		(−2.45)	(−1.19)	
	TNA			PTR			Flow volatility		
MT portfolio	Low	High	H-L	Low	High	H-L	Low	High	H-L
Low	−1.00	−0.06	0.94*	−0.27	−3.51**	−3.20**	−0.48	−0.13	0.35
	(−1.55)	(−0.09)	(1.72)	(−0.43)	(−2.26)	(−2.24)	(−0.75)	(−0.16)	(0.50)
2	−0.52	−1.23*	−0.71	−0.87	−1.69*	−0.82	−0.86	−0.95	−0.09
	(−0.75)	(−1.76)	(−1.31)	(−0.89)	(−1.66)	(−1.13)	(−1.19)	(−1.08)	(−0.11)
3	−0.16	−1.61**	−1.40**	−1.36	−1.70**	−0.34	−0.84	−2.57***	−1.69
	(−0.21)	(−2.43)	(−2.26)	(−1.38)	(−2.88)	(−1.27)	(−1.14)	(−2.60)	(−1.62)
4	−0.43	−1.64**	−1.21*	−2.28*	−1.91*	0.37	−1.72*	−1.94**	−0.22
	(−0.54)	(−2.03)	(−1.75)	(−1.83)	(−1.89)	(0.82)	(−1.93)	(−2.11)	(−0.27)
High	−1.07	−2.83**	−1.76**	−1.84*	−2.60**	−0.75	−2.84**	−2.37*	0.47
	(−1.08)	(−2.30)	(−2.10)	(−1.70)	(−2.06)	(−0.49)	(−2.20)	(−1.87)	(0.47)
H-L	−0.07	−2.77**		−1.58	0.68		−2.36*	−2.24*	
t-stat.	(−0.07)	(−2.14)		(−1.44)	(0.15)		(−1.82)	(−1.74)	

Panel B: funds are sorted by MT and activeness measures

	ICI			Active Share			Active Weight		
MT portfolio	Low	High	H-L	Low	High	H-L	Low	High	H-L
Low	−0.77	0.27	1.04	−1.32*	0.63	1.95*	−0.32	−0.40	−0.09
	(−1.28)	(0.31)	(1.26)	(−1.87)	(0.50)	(1.55)	(−0.44)	(−0.57)	(−0.12)

(*continued*)

Table V.

2	−0.91*	−1.35*	−0.45	−0.29	−0.62	−0.33	−1.29**	−0.85	0.44
	(−1.48)	(−1.53)	(−0.62)	(−0.39)	(−0.58)	(−0.40)	(−2.01)	(−1.02)	(0.63)
3	−1.33**	−1.68*	−0.32	−1.44**	−1.09	0.41	−1.89**	−0.98	0.90
	(−2.16)	(−1.68)	(−0.33)	(−1.86)	(−1.03)	(0.43)	(−2.43)	(−1.32)	(1.15)
4	−1.65**	−1.62	0.03	−1.87**	−1.70	0.18	−2.59***	−0.80	1.79**
	(−2.16)	(−1.50)	(0.03)	(−2.06)	(−1.36)	(0.16)	(−3.07)	(−0.77)	(1.81)
High	−3.70***	−1.94	1.76*	−2.95**	−2.71**	0.24	−3.14***	−2.31*	0.83
	(−3.90)	(−1.33)	(1.63)	(−2.01)	(−1.81)	(0.19)	(−2.68)	(−1.73)	(1.07)
H-L	−2.93***	−2.21		−1.63	−3.34**		−2.82**	−1.90	
t-stat.	(−3.02)	(−1.45)		(−1.12)	(−1.92)		(−2.45)	(−1.48)	

	R^2			Return Gap		
MT portfolio	Low	High	H-L	Low	High	H-L
Low	0.10	−1.04	−1.15	−0.23	−1.08	−0.85
	(0.12)	(−1.54)	(−1.25)	(−0.33)	(−1.15)	(−0.94)
2	−0.86	−0.31	0.55	−1.05	−0.41	0.64
	(−0.72)	(−0.47)	(0.50)	(−1.13)	(−0.39)	(0.59)
3	−0.77	−1.74***	−1.01	−1.11	−2.25***	−1.08
	(−0.75)	(−2.72)	(−1.11)	(−1.34)	(−2.38)	(−1.09)
4	−2.06**	−1.48*	0.58	−2.03**	−1.00	1.02
	(−2.17)	(−1.64)	(0.68)	(−1.95)	(−0.95)	(0.93)
High	−3.18***	−3.43***	−0.25	−2.62**	−2.87**	−0.25
	(−2.10)	(−3.61)	(−0.21)	(−2.20)	(−2.17)	(−0.30)
H-L	−3.29**	−2.39**		−2.39**	−1.79	
t-stat.	(−2.01)	(−2.31)		(−2.12)	(−1.25)	

Notes: Table V displays risk-adjusted returns (annualized and in percentages) net of fees, and *t*-statistics (in parentheses), for fund groups sorted by modified turnover (MT) and by each of the following fund characteristics in Panel A: flows, return_12m, expense ratio, TNA, portfolio turnover ratio (PTR) and flow_volatility_12m and by each of the following activeness measures in Panel B: industry concentration index (ICI), Active Share (AS), Active Weight (AW), R^2, and Return Gap (RG). Each quarter, funds are assigned to one of (5 × 2) portfolios according to MT and fund characteristic (an activeness measure, in Panel B). Then, we save the fund's return over the next three months, compute the TNA-weighted returns of these portfolios and run monthly regressions of excess returns on the four Carhart factors using the full sample period. The bottom two rows display the difference in α's between the top and bottom MT-sorted quintiles for each fund characteristic (activeness measure, in Panel B) group, and the (Newey-West) *t*-statistic for this difference. *,**,***Significant at 10, 5 and 1 percent levels, respectively more negative and significant difference in the less active fund group. Thus, these results suggest the presence of skill amongst the more active funds as the negative MT-performance relation is less marked for these funds when grouped according to ICI, AW, and RG. Only the AS measure contradicts this result.

In sum, MT interacts with some of the fund characteristics and activeness measures mentioned above. Thus, MT should be used in combination with other activeness measures, a fact that has proved to enlarge the spread between the bottom and top portfolios.

3.1.3 Regression analysis. To further investigate the relation between MT and fund performance, we use the same procedure as in Amihud and Goyenko (2013) and Doshi *et al.* (2015) to estimate monthly abnormal returns. We first obtain Carhart factor loadings from a 36-month rolling window regression of fund excess returns on four factors. After that, we compute next-month predicted returns by multiplying the factor loadings by next-month factor returns. We then subtract predicted returns from the observed excess returns to get the abnormal returns. To test the impact of MT on fund performance, we use the following monthly panel regression[12]:

$$
\begin{aligned}
\alpha_{j,t+1} = {} & a_0 + a_1\,\mathrm{MT}_{j,t} + a_2\,\mathrm{PTR}_{j,t} + a_3\,\mathrm{ICI}_{j,t} + a_4\,\text{Active Share}_{j,t} \\
& + a_5\,\text{Active Weight}_{j,t} + a_6\,R^2_{j,t} + a_7\,\text{Return Gap}_{j,t} \\
& + a_8\,\mathrm{MT}_{j,t} \times \mathrm{PTR}_{j,t} + a_9\,\mathrm{MT}_{j,t} \times \text{flows}_{j,t} + a_{10}\,\text{returns\_12m}_{j,t} \\
& + a_{11}\,\text{volatility\_12m}_{j,t} + a_{12}\,\text{flows}_{j,t} + a_{13}\,\text{flow\_volatility\_12m}_{j,t} \\
& + a_{14}\ln\left(\mathrm{TNA}_{j,t}\right) + a_{15}\ln\left(\text{number of stocks}_{j,t}\right) + a_{16}\,\text{expense ratio}_{j,t} \\
& + a_{17}\,\text{fund age}_{j,t} + \sum_{s=1}^{7} b_s \text{style dummy}_{j,s,t} + \varepsilon_{j,t}
\end{aligned}
\tag{7}
$$

where $\alpha_{j,t+1}$ is the risk-adjusted p@\hskip -1pcerformance (annualized and as a percentage) of fund j in month t+1. The independent variables are defined in Table AI. The regression in Equation (7) is run using fund-clustered standard deviations and monthly dummy variables (Petersen, 2009), and lower-frequency variables (i.e. quarterly or annual variables) are transformed into monthly variables and left unadjusted.

Panel A of Table VI reports the regression results for Equation (7) and shows that MT is negatively and significantly related to the following month's risk-adjusted performance for all specifications[13]. Therefore, an increase in portfolio churning reduces the portfolio's performance for the next month. Specifically, an increase of 10 percent (per quarter) in the fund's MT decreases the risk-adjusted performance by 34 bp per year, which is economically significant. When we control for different activeness measures, the statistical significance of the MT coefficient remains unchanged. These results imply that portfolio managers alter their holdings based on noise rather than valuable information, thereby destroying value. These results confirm the findings of Agarwal *et al.* (2014) for traditional turnover but contradict those of Chevalier and Ellison (1999), who find a positive effect of traditional turnover on performance. Furthermore, we confirm the results on activeness measures, as we find that ICI, AS, AW, one minus R^2, and RG are all positively related to next-period performance. Thus, MT captures a dimension that is not captured by activeness measures and relates negatively to next-period performance[14].

We find that higher flows and a smaller expense ratio predict good risk-adjusted performance for funds. The coefficient for total net assets is negative and significant, which supports the idea of diseconomies of scale whereby, as funds get larger, they find it more challenging to maintain good performance (Chen *et al.*, 2004). The negative return coefficient

Table VI. Multivariate regressions: predicting risk-adjusted performance with modified turnover

Panel A: baseline specification										
α_{t+1}	1	2	3	4	5	6	7	8	9	10
Activeness measures										
Modified turnover	−3.417***		−3.521***	−2.903**	−3.477***	−3.309***	−3.407***	−3.856***	−2.565***	−3.036***
	(−5.23)		(−5.22)	(−2.39)	(−5.27)	(−4.26)	(−5.25)	(−5.86)	(−3.73)	(−3.84)
Turnover		−0.496***	−0.012	0.171						0.186
		(−4.15)	(−0.07)	(0.60)						(0.89)
ICI					5.084**					3.227
					(2.32)					(1.23)
Active Share						3.032***				0.702
						(3.83)				(0.68)
Active Weight							3.111***			2.340*
							(3.96)			(1.95)
R^2								−8.330***		−5.989***
								(−5.10)		(−3.02)
Annual Return Gap									7.025**	11.200***
									(2.35)	(3.29)
MT × Turnover				−0.550						
				(−0.64)						
MT × Flows				24.738***						
				(3.82)						
Fund characteristics										
Return_12m	−0.638	0.331	−0.705	−0.785*	−0.722*	−0.713	−0.823*	−0.498	−0.713	−0.661
	(−1.46)	(0.81)	(−1.61)	(−1.80)	(−1.66)	(−1.19)	(−1.88)	(−1.14)	(−1.54)	(−1.07)
Volatility_12m	−0.167	−1.167	−0.290	−0.457	−0.581	2.258	−0.554	1.629	2.022	2.840
	(−0.13)	(−0.94)	(−0.23)	(−0.36)	(−0.47)	(1.34)	(−0.44)	(1.20)	(1.52)	(1.60)
Flows	4.310***	3.959***	4.243***	−1.698	4.334***	3.927***	4.092***	3.877***	4.123***	3.090***
	(6.24)	(6.41)	(6.18)	(−1.13)	(6.25)	(4.56)	(5.96)	(5.72)	(5.27)	(3.56)
Flow_volatility12m	0.076	0.092	0.089	0.089	0.073	0.017	0.103	0.090	0.033	0.093
	(0.60)	(0.81)	(0.69)	(0.69)	(0.57)	(0.06)	(0.81)	(0.71)	(0.20)	(0.33)
LN(TNA)	−0.136***	−0.127***	−0.126**	−0.123**	−0.145***	−0.121*	−0.124**	−0.137***	−0.119**	−0.083
	(−2.73)	(−2.70)	(−2.51)	(−2.47)	(−2.88)	(−1.92)	(−2.46)	(−2.77)	(−2.09)	(−1.29)
LN(n_stocks)	−0.071	−0.071	−0.055	−0.081	0.032	0.042	−0.037	0.211	−0.199	0.117
	(−0.59)	(−0.63)	(−0.45)	(−0.67)	(0.26)	(0.24)	(−0.30)	(1.61)	(−1.48)	(0.60)
Expense ratio	−130.765***	−111.551***	−124.527***	−127.652***	−134.138***	−149.788***	−144.442***	−140.002***	−129.734***	−148.676***
	(−6.20)	(−5.69)	(−5.82)	(−5.92)	(−6.30)	(−5.93)	(−6.94)	(−6.65)	(−5.87)	(−5.97)
Fund age, years	0.008	0.005	0.007	0.006	0.008	0.015	0.008	0.008	0.008	0.011
	(0.93)	(0.59)	(0.83)	(0.76)	(0.90)	(1.43)	(0.94)	(0.98)	(0.90)	(1.01)

(continued)

Intercept	3.957***	3.039***	1.747	1.872*	3.558***	−0.976	0.542	8.227***	3.564*	6.279***
	(3.69)	(2.80)	(1.58)	(1.70)	(3.37)	(−0.55)	(0.48)	(5.35)	(1.90)	(2.95)
n	130,282	159,386	128,000	128,000	129,603	92,827	129,324	127,194	108198	87,607
Adj. R^2	0.011	0.009	0.011	0.012	0.011	0.014	0.011	0.012	0.015	0.015

Panel B: alternative assumptions and model specifications

Dependent variable			α_{t+1}				CS_{t+1}	CT_{t+1}
MT measure	Orthogonalized on flows	New positions	Existing positions	Buys	Sells	MT with fixed effects	MT	MT
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Activeness measures								
Modified turnover	−3.036***	−5.506***	−4.376***	−4.375***	−6.009***	−1.855	−4.212***	0.558
	(−3.84)	(−3.16)	(−3.48)	(−2.90)	(−3.92)	(−1.41)	(−5.46)	(1.03)
Turnover	0.186	0.206	0.213	0.199	0.207	0.184	−0.218	0.248*
	(0.89)	(0.99)	(1.03)	(0.96)	(1.00)	(0.60)	(−1.23)	(1.92)
ICI	3.227	3.221	3.243	2.953	3.214	9.542*	−8.534***	9.094***
	(1.23)	(1.23)	(1.24)	(1.13)	(1.23)	(1.83)	(−3.06)	(5.86)
Active Share	0.702	0.775	0.664	0.658	0.742	−2.803	−5.574***	4.089***
	(0.68)	(0.75)	(0.64)	(0.63)	(0.72)	(−1.52)	(−5.39)	(6.00)
Active Weight	2.340*	2.280*	2.408**	2.435**	2.366**	2.014	5.226***	−0.246
	(1.95)	(1.89)	(2.01)	(2.02)	(1.97)	(1.01)	(4.38)	(−0.31)
R^2	−5.989***	−5.818***	−5.872***	−5.707***	−5.891***	−7.775***	−8.214***	7.316***
	(−3.02)	(−2.93)	(−2.96)	(−2.86)	(−2.97)	(−3.36)	(−4.51)	(5.58)
Annual Return Gap	11.200***	11.182***	11.307***	11.350***	11.288***	3.184	11.164***	3.157
	(3.29)	(3.28)	(3.32)	(3.31)	(3.31)	(0.83)	(3.12)	(1.17)
Intercept	5.617***	5.975***	6.216***	4.969**	5.353**	16.985***	10.779***	−8.263***
	(2.65)	(2.80)	(2.92)	(2.28)	(2.47)	(4.56)	(4.10)	(−5.51)
n	87,607	87,348	87,607	87,382	87,596	87,607	90,891	77,599
Adj. R^2	0.015	0.015	0.015	0.015	0.015	0.017	0.010	0.020
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fund fixed effects	No	No	No	No	No	Yes	No	No

Notes: Panel A of Table VI reports the monthly regression results of fund risk-adjusted returns (annualized and in percentages) on the one-month-lagged fund characteristics: modified turnover (MT), turnover, ICI, Active Share, Active Weight, R^2, Return Gap, MT interacted with turnover, MT interacted with flows, return_12m, volatility_12m, flows, flow_volatility_12m, total net assets (TNA), logarithm of number of stocks, expense ratio and fund age (in years). Monthly risk-adjusted returns are computed as the difference between the observed fund returns and predicted returns. The latter are computed using the estimates of the Carhart model over the last 36 months. Panel B reports the results of the regression for alternative assumptions and model specifications. The first six columns use Carhart α as a dependent variable, while the last two columns use the CS and CT as a dependent variable. In the first column, MT is first orthogonalized on flows and then used as an independent variable. The next two columns decompose MT into new and existing position measures. Columns (4) and (5) decompose MT into buy and sell measures. The sixth column includes the original MT, while using fund fixed effects. For brevity, in Panel B, the control variable coefficients have been dropped. All regressions include time (month) and style dummies. *,**,***Significant at 10, 5 and 1 percent levels, respectively

Table VI.

might seem counterintuitive at first, but the correlation between the risk-adjusted performance and lagged returns is positive. Thus, this relation is subsumed by the other control variables included in the regression model.

3.1.4 Regression analysis: alternative assumptions and model specifications. Important to our analysis on the performance-turnover relationship is that turnover activity can be triggered by either discretionary or forced trading. To rule out the latter alternative, we examine the effects of flows on the MT-performance relationship and add several alternative specifications of Equation (7). First, similar to Lou (2012), we purge MT from the effects of flows by regressing MT on flows and using the residuals as an independent variable[15]. Panel B of Table VI reports the results of this alternative specification and confirms the negative relationship between MT and risk-adjusted performance. Second, we compute MT separately for new openings and existing positions. We find that while both these measures are significant, MT based on new openings has higher impact on performance than existing positions. Thus, managers seem to take better advantage of seasoned than newly opened positions. Third, similar to Yan and Zhang (2009), we compute MT separately for buys and sells. While, both these versions of MT are highly significant, the sells version has a higher and thus a more damaging impact on performance than buys version. This is consistent with the idea that sells may occur in more difficult conditions than buys.

Furthermore, we estimate the regression of Equation (7) using fund fixed effects and find that the MT coefficient is not statistically significant. This confirms our intuition that the MT-performance is primarily a cross-sectional rather than a time-series relationship. Furthermore, Pastor *et al.* (2016) suggest that the negative cross-sectional relationship between MT and performance can also be attributed to an overestimation of the level of skill due to overconfidence.

Finally, we use two Daniel *et al.*'s (1997) measures, characteristic selectivity (CS) and characteristic timing (CT), as additional measures of risk-adjusted performance to further consider potential effects of style exposure on our results. We find that MT negatively predicts CS but displays no significant relationship with CT.

3.1.5 MT and long-term performance. Sections 3.1.1 and 3.1.3 consider the prediction of performance over next three months, which is in accordance with the time span of the literature on short-term performance prediction. We now further look at whether funds sorted on MT deliver statistically significant performance differences over longer time horizons. We repeat the same simple sort as in Table IV and consider horizons ranging from six months up to five years. The only difference from the three-month horizon specification is that the sorts are now conducted over overlapping periods, whereby a fund could, for example, be assigned to different ranks according to MT over the last three and six months.

The results of Table VII show that the difference in the risk-adjusted α's remains negative for all of the time horizons considered. Moreover, the magnitude of the difference and its corresponding t-statistic show an increase over longer horizons[16].

3.2 Predicting fund flows using MT

Although the results in the previous section show that portfolio churning is not based on valuable information, investors may still perceive portfolio activity as a signal of a fund manager's information set and skill. Investors chasing high-performing funds might be interested in following such signals as indications of a manager's skills. If this were the case, we expect a higher MT to predict higher fund flows. Chevalier and Ellison (1997) show a strong relation between past performance and fund flows, whereby investors chase high-performing funds.

As in Agarwal *et al.* (2014), we aim to study the relation between fund flows and activeness measures beyond the flow-performance relation and to test whether investors

MT portfolio	6 months	1 year	2 years	3 years	4 years	5 years
Panel A: modified turnover and long-term performance: net fund returns						
Low	−0.27	−0.31	−0.21	−0.06	−0.05	0.01
2	−0.87	−0.78	−0.53	−0.46	−0.42	−0.35
3	−1.43**	−1.48***	−1.34**	−1.10**	−0.97*	−0.92*
4	−1.83***	−2.06***	−1.91***	−2.05***	−1.74***	−1.52**
High	−2.26**	−2.36***	−2.53***	−2.35***	−2.32***	−2.13***
High-Low	−1.99*	−2.05**	−2.32***	−2.28***	−2.27***	−2.14***
t-statistic	(−1.86)	(−2.04)	(−2.82)	(−3.03)	(−3.11)	(−2.97)
Panel B: modified turnover and long-term performance: gross fund returns						
Low	0.69	0.65	0.74	0.88*	0.89*	0.95*
2	0.12	0.21	0.45	0.53	0.56	0.63
3	−0.35	−0.41	−0.27	−0.03	0.09	0.15
4	−0.66	−0.89	−0.74	−0.88	−0.57	−0.35
High	−1.07	−1.17	−1.34*	−1.16	−1.14	−0.94
High-Low	−1.75	−1.81*	−2.08***	−2.04***	−2.03***	−1.90***
t-statistic	(−1.65)	(−1.81)	(−2.54)	(−2.73)	(−2.80)	(−2.65)

Notes: Table VII reports the net and gross risk-adjusted α's (annualized and in percentages) computed for a horizon h from 6 months to 5 years following the modified turnover (MT) computation. Panel A reports risk-adjusted α's net of fees. Panel B reports risk-adjusted α's gross of fees. Each quarter, each fund is assigned to one of five quintiles according to its modified turnover and then we keep that fund for the next h months. We then regress the TNA value-weighted excess returns of these portfolios over the four factors of the Carhart model. The bottom two rows report the difference between the largest and smallest quintiles and the (Newey-West) t-statistic of the difference. *,**,***Significant at 10, 5 and 1 percent levels, respectively

Table VII. Modified turnover and long-term performance

react strongly to holdings-based measures. To achieve this, we estimate a regression of fund flows on MT. We control for important flows-performance (with lagged returns) relation and for common fund characteristics. Furthermore, since fund flows show high persistence over time (Warther, 1995), we include lagged flows as an additional control variable. We use the following equation:

$$\begin{aligned}\text{flows}_{j,t+1} = {} & a_0 + a_1\,\text{MT}_{j,t} + a_2\,\text{Dummy MT}_{j,t} + a_3\,\text{PTR}_{\text{j,t}} + a_4\,\text{ICI}_{j,t} \\ & + a_5\,\text{Active Share}_{j,t} + a_6\,\text{Active Weight}_{j,t} + a_7\,R^2_{j,t} \\ & + a_8\,\text{Return Gap}_{j,t} + a_9\,\text{return\_12m}_{j,t} + a_{10}\,\text{volatility\_12m}_{j,t} \\ & + a_{11}\,\text{flows}_{j,t} + a_{12}\ln(\text{TNA}_{j,t}) + a_{13}\ln(\text{number of stocks}_{j,t}) \\ & + a_{14}\,\text{expense ratio}_{j,t} + a_{15}\,\text{fund age}_{j,t} + \sum_{s=1}^{7} b_s \text{style dummy}_{j,s,t} + \varepsilon_{j,t} \qquad (8)\end{aligned}$$

where $\text{flows}_{j,t+1}$ are the net flows for fund i in quarter t+1 and are defined as in Equation (4). The independent variables are defined in Table AI. In the regression, standard deviations are fund-clustered, quarter dummy variables are included, and lower-frequency variables (i.e. annual variables) are transformed into quarterly variables and left unadjusted.

Table VIII shows the quarterly panel regression results for Equation (8) and shows that investors punish a fund when it increases its portfolio trading by withdrawing their money. Specifically, MT loads negatively and significantly on the next quarter's flows. Column (1) shows MT coefficient equal to −0.011, which indicates that an increase of 10 percent in MT decreases fund flows by 0.11 percent per quarter (or about 0.44 percent per year), implying an economically meaningful relation between the two variables. The relation between MT and flows holds even when we control for performance, past flows, and other common fund

Table VIII.
Multivariate regressions: predicting fund flows with modified turnover

	Full sample										Low-12b −1 funds	High-12b −1 funds
$Flows_{t+1}$	1	2	3	4	5	6	7	8	9	10	11	12
Activeness measures												
Modified turnover	−0.011***			−0.012***	−0.011***	−0.016***	−0.013***	−0.015***	−0.011**	−0.019***	−0.020***	−0.004
	(−2.65)			(−2.81)	(−2.66)	(−3.35)	(−3.04)	(−3.57)	(−2.42)	(−3.72)	(−2.89)	(−0.73)
Dummy MT		−0.003***										
		(−2.91)										
Turnover			−0.003***	−0.003***						−0.004***		
			(−3.04)	(−3.06)						(−3.21)		
ICI					0.015					−0.060***		
					(1.09)					(−3.81)		
Active Share						0.043***				0.032***		
						(6.87)				(4.31)		
Active Weight							0.037***			0.012		
							(6.32)			(1.62)		
R^2								−0.070***		−0.053***		
								(−7.35)		(−4.54)		
Annual Return Gap									0.093***	0.119***		
									(5.59)	(6.40)		
Fund characteristics												
Return_lag12m	0.038***	0.038***	0.037***	0.036***	0.037***	0.050***	0.036***	0.037***	0.039***	0.047***	0.034***	0.043***
	(16.87)	(17.41)	(16.45)	(16.23)	(16.76)	(15.98)	(16.06)	(16.50)	(16.72)	(15.08)	(9.49)	(12.00)
Volatility_lag12m	0.018**	0.017**	0.014**	0.016**	0.017**	0.053***	0.014**	0.036***	0.022***	0.059***	−0.001	0.025**
	(2.51)	(2.49)	(1.97)	(2.31)	(2.34)	(6.47)	(1.97)	(4.98)	(3.12)	(6.98)	(−0.07)	(2.47)
Flows	0.413***	0.411***	0.410***	0.411***	0.413***	0.412***	0.412***	0.408***	0.413***	0.405***	0.372***	0.467***
	(44.08)	(43.90)	(43.29)	(43.32)	(43.93)	(38.79)	(43.82)	(40.61)	(38.63)	(33.60)	(25.22)	(29.92)
LN(TNA)	−0.002***	−0.003***	−0.002***	−0.002***	−0.002***	−0.003***	−0.002***	−0.002***	−0.002***	−0.003***	−0.003***	−0.003***
	(−7.20)	(−7.74)	(−6.68)	(−7.02)	(−7.19)	(−7.29)	(−7.03)	(−6.44)	(−5.90)	(−5.79)	(−4.39)	(−5.70)
LN(n_stocks)	−0.000	−0.000	0.000	0.000	0.000	0.006***	0.001	0.002**	0.000	0.006***	0.002	−0.001
	(−0.01)	(−0.03)	(0.05)	(0.34)	(0.37)	(4.60)	(0.58)	(2.26)	(0.01)	(3.94)	(1.31)	(−0.40)
Expense ratio	−0.614***	−0.706***	−0.607***	−0.567***	−0.619***	−0.698***	−0.719***	−0.705***	−0.657***	−0.658***	−0.918**	−0.972***
	(−4.02)	(−4.65)	(−3.86)	(−3.60)	(−4.05)	(−3.92)	(−4.70)	(−4.52)	(−3.94)	(−3.42)	(−2.53)	(−3.60)
Fund age, years	−0.001***	−0.001***	−0.001***	−0.001***	−0.001***	−0.001***	−0.001***	−0.001***	−0.001***	−0.001***	−0.001***	−0.001***

(*continued*)

Table VIII.

Flows$_{t+1}$	1	2	3	4	5	6	7	8	9	10	Low-12b −1 funds 11	High-12b −1 funds 12
					Full sample							
	(−10.70)	(−10.83)	(−10.42)	(−10.46)	(−10.71)	(−10.19)	(−11.14)	(−9.56)	(−10.05)	(−8.87)	(−6.18)	(−7.54)
Intercept	0.052***	0.055***	0.044***	0.046***	0.051***	−0.029**	0.036***	0.096***	0.055**	0.050***	0.051***	0.061***
	(3.92)	(4.20)	(3.19)	(3.35)	(3.80)	(−1.99)	(2.68)	(6.92)	(2.57)	(3.24)	(3.05)	(3.39)
n	46,836	46,836	45,943	45,943	46,568	34,578	46,489	44,172	38,458	31,034	17,142	17,886
Adj. R^2	0.310	0.312	0.307	0.307	0.310	0.328	0.312	0.295	0.304	0.308	0.264	0.379

Notes: Table VIII reports the results of quarterly regressions of fund flows on the one-quarter lagged fund characteristics: modified turnover (MT), turnover (PTR), ICI, Active Share, Active Weight, R^2, Return Gap, return_12m, volatility_12m, flows, logarithm of total net assets (TNA), logarithm of number of stocks, expense ratio and fund age (in years). The regression includes time (quarter) and style dummies. Standard deviations are clustered by fund. *,**,***Significant at 10, 5 and 1 percent levels, respectively characteristics. The relation between PTR and subsequent flows is negative even when MT is not included in the specification. Furthermore, the negative coefficient of MT remains when we control individually for each activeness measure or simultaneously as in the last column. Together with the results from the previous section, these results show that investors are not duped by the signal provided by active changes in weights of a portfolio and even penalize managers who unnecessarily churn their portfolios.

As MT measure may not be precisely computed by investors, we test whether investors react to a less precise definition of MT. To do so, we introduce a dummy MT variable that equals 1 if the fund has an above-median MT and 0 otherwise. Results from column (2) indicate that fund flows continue to be negatively related to this alternative definition of MT. Thus, investors are able to figure out approximately if a fund has a high or low MT and react consequently.

Furthermore, investors appear to invest in funds that experience higher volatility during the previous year, which is consistent with the idea that investors chase riskier investments. Also, the lagged flows' coefficient is highly significant and confirms that fund flows show strong persistence over the quarters. Consistent with Chevalier and Ellison (1997), we find a significant and positive relation between fund flows and past fund net returns. We therefore confirm our intuition that investors react to holdings-based measures, such as MT, even after we control for return-based measures. The negative coefficient on TNA is consistent with the idea of diseconomies of scale, whereby as funds get larger they have more difficulty maintaining a high rate of growth in their assets under management. Finally, increases in the fund expense ratio and fund age seem to be counterproductive in attracting new inflows, as displayed by their respective negative coefficients[17].

The last two specifications report the regression results for funds when sorted on their 12b-1 fees (above- and below-median groups). The low group is likely to proxy for direct-sold funds and the high group for broker-sold funds. The results show that MT is more significant for the low-12b-1 group. Hence, for funds in which the role of the broker is limited, investors are able to interpret the high level of MT as a lack of skill and therefore are more sensitive to MT. Brokers tend, however, to disturb this signal, and therefore MT is not significant for broker-sold funds.

4. Conclusion

In this paper, we offer a new portfolio holdings-based measure, the MT, for assessing the portfolio activity of mutual funds. Our MT measure assesses the deviation of a fund's portfolio weights relative to those from one quarter earlier. In comparison to the traditional turnover ratio, the MT has a distinct interpretation, relies on portfolio holdings, includes the effects of flows, and ignores the effects of offsetting trades. Next, we examine the determinants of MT and investigate whether funds deviate from their previous quarter's holdings because of valuable or noisy information and whether such signals are exploited by fund investors.

We find that MT is explained by fund characteristics such as flows, fund returns, size, number of stocks, and expense ratios, and also by investment styles such as investing in high-β stocks, small stocks, growth stocks and momentum strategies. More specifically, we observe that past fund performance is negatively related to MT, indicating that poorly performing managers alter their portfolios more dramatically than better-performing ones, who tend to reduce the MT of their funds. Further, we find that flows positively relate to MT.

Furthermore, our results show that higher MT is associated with lower future risk-adjusted performance. The difference between the high and low modified-turnover-sorted portfolios is −2.41 percent per year after, and −2.17 percent per year before, deducting fees. The predictive regression further confirms this negative relation even when additional measures of activeness and common fund characteristics are taken into account. We also find that MT has significant predictability for performance over longer horizons of one to five years. Together, these results indicate that active management, or greater deviation from a buy-and-hold strategy, is not necessarily value-enhancing and can even destroy value.

Finally, we find that MT is associated with reduced fund flows, indicating that investors chase funds with lower MT. This observation lends credence to a weak belief among fund investors in the value of active management.

Notes

1. Another strand of the mutual fund literature has indirectly examined the impact of turnover on fund performance by including turnover as a control variable in the regression model. Kacperczyk *et al.* (2005), Cremers and Petajisto (2009), Huang *et al.* (2011), and Simutin (2012) find no relation between turnover and performance. Chevalier and Ellison (1999) find a positive effect of fund turnover on fund performance. Agarwal *et al.* (2014) observe a negative effect of fund turnover on subsequent risk-adjusted performance.
2. MT also captures the impact of offsetting trades; however, because we do not observe every trade in the portfolio, we can draw no inference from it.
3. The MT measure equals half of the sum of the absolute differences between the quarter t weights of the actual and buy-and-hold portfolios. See Section 2.2 for a detailed discussion of the measure.
4. See Appendix 2, for examples, to better understand the differences between PTR and MT.
5. MT builds on Carhart's (1997) idea that argues turnover measure should capture the impact of net flows of mutual fund's trading activity. The author offers a measure which distinguishes between buy and sell turnovers, which are equal to turnover plus net inflows and minus net outflows, respectively. Our MT measure incorporates the impact of flows on portfolio allocation instead of adding the percentage of flows to turnover.
6. It is important to note that MT does not capture information about active bets of the portfolio manager but rather captures portfolio trading activity over time.
7. This result holds for all activeness measures except Active Share.
8. The weights are summed across all stock positions and do not include other asset classes (such as bonds, cash, etc.). We thus examine the turnover of the equity portion of the portfolio only. Consequently, we adjust the weights in Equation (1) by dividing them by the sum of the weights and obtain a sum of adjusted weights equal to 1. We also conduct tests without this weight adjustment, and the results remain unchanged. Since we are working on funds mainly invested in equity, the impact of this issue is quite limited.
9. Please refer to Table AI for definitions of the activeness measures. Furthermore, we would like to thank Mikhail Simutin for making the SAS code for the Active Weight measure available on his website and Antti Petajisto for making the Active Share data available on his website. In our sample, the Active Share data starts in March 1991 and ends in September 2009. We follow Kacperczyk *et al.* (2005, 2008) to compute the ICI and Return Gap, respectively. Finally, we follow Amihud and Goyenko (2013) to compute the R^2 of the Carhart model.
10. Multicollinearity is not an important issue for any of the explanatory variables as all correlation coefficients range between −45 and 42 percent, with the exception of PTR which is highly correlated with MT (63 percent). This issue is addressed in Equation (6). As a robustness test, we estimated the variance inflation factors and found none to be higher than 2.
11. We conduct 5×5 sorts and report the results in the Internet Appendix.
12. Since PTR and MT are highly correlated, a multicollinearity issue emerges. To minimize its bias, we orthogonalize PTR on MT. We then run a regression of PTR on MT and save the residuals, which are then inserted into column (8) in place of PTR. We also run Equation (7) including PTR

and MT and without any orthogonalization. The results stand as only the coefficient of MT is negative and significant, while that of PTR is insignificant.

13. For robustness, we also estimate the Fama-Macbeth approach using the Newey-West adjusted standard deviations with a lag of 3. The results were qualitatively similar and supported the negative relation between Modified Turnover and next-month α's.
14. The results are also robust using a 24-month instead of 36-month estimation window.
15. In the reported results, we regress MT on fund flows and one-quarter lagged flows using a pooled regression. However, we also conduct the same regression on each fund while including higher-order lagged flows and controlling for fund characteristics. The results remain very similar.
16. In unreported results, we examined the relationship between MT and exit probability. Our results revealed that higher MT increases the probability of fund exit for different horizons from 12 to 60 months.
17. Coval and Stafford (2007) argue that funds that face large outflow movements may trade out of necessity. To make sure that our results are not contaminated by that effect, we estimate regression (8) while winsorizing the top and bottom 10 percent of funds as sorted by their flows. The results are even stronger than those presented in Table VIII.
18. We assume that all trades occur at the end of the quarter or are observable only at the end of the quarter so as to allow analytical tractability of the proof.
19. For simplicity, we assume that stock prices remain the same from t to t+1.

References

Agarwal, V., Gay, G.D. and Ling, L. (2014), "Window dressing in mutual funds", *Review of Financial Studies*, Vol. 27 No. 11, pp. 3133-3170.

Alexander, G.J., Cici, G. and Gibson, S. (2007), "Does motivation matter when assessing trade performance? An analysis of mutual funds", *Review of Financial Studies*, Vol. 20 No. 1, pp. 125-150.

Amihud, Y. and Goyenko, R. (2013), "Mutual fund's R^2 as predictor of performance", *Review of Financial Studies*, Vol. 26 No. 3, pp. 667-694.

Carhart, M.M. (1997), "On persistence in mutual fund performance", *Journal of Finance*, Vol. 52 No. 1, pp. 57-82.

Chen, H.-L. and Pennacchi, G.G. (2009), "Does prior performance affect a mutual fund's choice of risk? Theory and further empirical evidence", *Journal of Financial and Quantitative Analysis*, Vol. 44 No. 4, pp. 745-755.

Chen, H.-L., Jegadeesh, N. and Wermers, R. (2000), "The value of active mutual fund management: an examination of the stockholdings and trades of fund managers", *Journal of Financial and Quantitative Analysis*, Vol. 35 No. 3, pp. 343-368.

Chen, J., Hong, H., Huang, M. and Kubik, J.D. (2004), "Does fund size erode mutual fund performance? The role of liquidity and organization", *American Economic Review*, Vol. 94 No. 5, pp. 1276-1302.

Chevalier, J. and Ellison, G. (1997), "Risk taking by mutual funds as a response to incentives", *Journal of Political Economy*, Vol. 105 No. 6, pp. 1167-1200.

Chevalier, J. and Ellison, G. (1999), "Are some mutual fund managers better than others? Cross-sectional patterns in behavior and performance", *Journal of Finance*, Vol. 54 No. 3, pp. 875-899.

Coval, J. and Stafford, E. (2007), "Asset fire sales (and purchases) in equity markets", *Journal of Financial Economics*, Vol. 86 No. 3, pp. 479-512.

Cremers, K.J.M. and Petajisto, A. (2009), "How active is your fund manager? A new measure that predicts performance", *Review of Financial Studies*, Vol. 22 No. 9, pp. 3329-3365.

Cullen, G., Gasbarro, D., Monroe, G.S. and Zumwalt, J.K. (2012), "Changes to mutual fund risk: intentional or mean reverting?", *Journal of Banking and Finance*, Vol. 36 No. 1, pp. 112-120.

Daniel, K., Grinblatt, M., Titman, S. and Wermers, R. (1997), "Measuring mutual fund performance with characteristic-based benchmarks", *Journal of Finance*, Vol. 52 No. 3, pp. 1035-1058.

Doshi, H., Elkamhi, R. and Simutin, M. (2015), "Managerial activeness and mutual fund performance", *Review of Asset Pricing Studies*, Vol. 5 No. 2, pp. 156-184.

Edelen, R., Evans, R. and Kadlec, G. (2013), "Shedding light on 'invisible' costs: trading costs and mutual fund performance", *Financial Analysts Journal*, Vol. 69 No. 1, pp. 33-44.

Elton, E.J., Gruber, M.J., Das, S. and Hlavka, M. (1993), "Efficiency with costly information: a reinterpretation of evidence from managed portfolios", *Review of Financial Studies*, Vol. 6 No. 1, pp. 1-22.

Fama, E.F. and French, K.R. (1993), "Common risk factors in the returns on stocks and bonds", *Journal of Financial Economics*, Vol. 33 No. 1, pp. 3-56.

Gaspar, J.-M., Massa, M. and Matos, P. (2005), "Favoritism in mutual fund families? Evidence on strategic cross-fund subsidization", *Journal of Finance*, Vol. 61 No. 1, pp. 73-104.

Grinblatt, M. and Titman, S. (1989), "Mutual fund performance: an analysis of quarterly portfolio holdings", *Journal of Business*, Vol. 62 No. 3, pp. 393-416.

Huang, J., Sialm, C. and Zhang, H. (2011), "Risk shifting and mutual fund performance", *Review of Financial Studies*, Vol. 24 No. 8, pp. 2575-2616.

Kacperczyk, M., Sialm, C. and Zheng, L. (2005), "On the industry concentration of actively managed equity mutual funds", *Journal of Finance*, Vol. 60 No. 4, pp. 1983-2011.

Kacperczyk, M., Sialm, C. and Zheng, L. (2008), "Unobserved actions of mutual funds", *Review of Financial Studies*, Vol. 21 No. 6, pp. 2379-2416.

Lou, D. (2012), "A flow-based explanation for return predictability", *Review of Financial Studies*, Vol. 25 No. 12, pp. 3457-3489.

Pastor, L., Stambaugh, R.F. and Taylor, L.A. (2016), "Do funds make more when they trade more?", *Journal of Finance*, Vol. 72 No. 4, pp. 1483-1528.

Petersen, M.A. (2009), "Estimating standard errors in finance panel data sets: comparing approaches", *Review of Financial Studies*, Vol. 22 No. 1, pp. 435-480.

Rakowski, D. and Wang, X. (2009), "The dynamics of short-term mutual fund flows and returns: a time-series and cross-sectional investigation", *Journal of Banking & Finance*, Vol. 33 No. 11, pp. 2102-2109.

Sapp, T. and Tiwari, A. (2005), "Does stock return momentum explain the 'smart money' effect?", *Journal of Finance*, Vol. 59 No. 6, pp. 2605-2622.

Simutin, M. (2012), "On incentives to stand out in the family: deviation from a family portfolio and mutual fund performance", working paper, University of Toronto, Toronto.

Warther, V.A. (1995), "Aggregate mutual fund flows and security returns", *Journal of Financial Economics*, Vol. 39 No. 2-3, pp. 209-235.

Wermers, R. (2000), "Mutual fund performance: an empirical decomposition into stock-picking talent, style, transactions costs, and expenses", *Journal of Finance*, Vol. 55 No. 4, pp. 1655-1695.

Yan, X.S. and Zhang, Z. (2009), "Institutional investors and equity returns: are short-term institutions better informed?", *Review of Financial Studies*, Vol. 22 No. 2, pp. 893-924.

Further reading

Newey, W.K. and West, K.D. (1987), "Hypothesis testing with efficient method of moments estimation", *International Economic Review*, Vol. 28 No. 3, pp. 777-787.

Corresponding author
Aymen Karoui can be contacted at: aymenkar@glendon.yorku.ca

Appendix 1

Table AI.
Variable definitions

Variable	Definition
Modified turnover (MT)	Equal to half of the sum of the absolute differences between the quarter *t* weights of the actual and buy-and-hold portfolios
Portfolio turnover ratio (PTR)	Minimum of aggregated sales or aggregated purchases of securities, divided by the average 12 month total net assets of the fund
Industry concentration index (ICI)	The sum of squared differences in industry weights between the mutual fund and the total market portfolio as defined in Kacperczyk *et al.* (2005)
Active Share (AS)	Equal to half of the sum of the absolute differences between the fund weights and the corresponding benchmark weights as defined in Cremers and Petajisto (2009)
Active Weight (AW)	Equal to half of the sum of the absolute differences between the actual weights and the theoretical market value weights of the portfolio as defined in Doshi *et al.* (2015)
R^2	R^2 of Amihud and Goyenko (2013) that is obtained from regressing the fund excess returns on the Carhart factors using a rolling window of 24 months
Return Gap	The average Return Gap (RG) over the last 12 months as defined in Kacperczyk *et al.* (2008)
Return_12m	The trailing 12-month cumulative return
Volatility_12m	The annualized return volatility computed over the last 12 months
Flows	The quarterly net flows defined as in Equation (4)
Flow_volatility_12m	The annualized flow volatility computed over the last 12 months
Total net assets (TNA)	Total net assets (TNA) in millions of $
Number of stocks	Number of stocks included in the portfolio
Expense ratio	Ratio of total net assets that shareholders pay for the fund's operating expenses, which include 12b-1 fees
Fund age	Age of the fund in years since its inception
Style dummy	A dummy variable that equals 1 if the fund belongs to style s and 0 otherwise
MT dummy	A dummy variable that equals 1 if a fund has an above-median MT in quarter *t* (and 0 otherwise)

Appendix 2. Impact of flows and offsetting trades on portfolio turnover ratio and modified turnover

One major advantage of our modified turnover measure is that it captures the impact of flows (both inflows and outflows) and offsetting trades on portfolio trading activity. In this appendix, we demonstrate (through different scenarios) how flows and offsetting trades impact portfolio turnover activity. We also show how the portfolio turnover ratio (PTR) and modified turnover (MT) capture these changes[18]:

$$\text{PTR} = \frac{\text{Min}(\$\text{Total sells},\ \$\text{Total purchases})}{\text{Avg.TNA}} \tag{A1}$$

$$\text{MT} = \frac{1}{2}\sum_{i=1}^{N_j} \left|\omega_{i,t}^{\text{observed}} - \omega_{i,t}^{\text{BH}}\right| \tag{A2}$$

Consider the following example: a portfolio at time *t* consists of two stocks A and B. One share of each stock is worth \$50. Hence, the total portfolio value equals \$100 with the weight in each stock 0.5. The portfolio changes at time *t*+1 in the following ways[19].

Impact of flows

Scenario 1: add a new equity position using new net inflows

The fund received net new inflows of \$100 at time *t*+1. The manager keeps the holdings in stock A and B unchanged and buys a new stock C using the new net inflows of \$100. Now the total portfolio value will be \$200 at time *t*+1 but the weights of stocks A and B will change from 0.5 to 0.25 between time *t* and *t*+1. Similarly, the weight of stock C will change from 0 to 0.5:

$$\text{Total sells} = \$0.\text{Total purchases} = \$100.\text{Average TNA} = \$150.$$

$$\text{PTR} = \$0/\$150 = 0 \text{ while MT} = 1/2 \times \left(|0.25–0.5| + |0.25–0.5| + |0.5–0|\right) = 0.5$$

Scenario 2: increase existing positions proportionally (scale-up) using new net inflows
The fund received net new inflows of $100 at time *t*+1. The manager purchases one additional share of stock A and of B, using the new net inflows of $100. Now the total portfolio value will be $200 at time *t*+1. The weights of stocks A and B will remain unchanged from time *t* to *t*+1 at 0.5:

$$\text{Total sells} = \$0.\text{Total purchases} = \$100.\text{Average TNA} = \$150.$$

$$\text{PTR} = \$0/\$150 = 0 \text{ while MT} = 1/2 \times (|0.5–0.5| + |0.5–0.5|) = 0$$

This scenario will remain identical when a manager scales down the portfolio proportionally.

Scenario 3: increase existing positions disproportionately (scale-up) using new net inflows
The fund received net new inflows of $100 at time *t*+1. The manager purchases two more shares of stock A alone, while keeping stock B's holdings constant, using the new net inflows of $100. Now the total portfolio value will be $200 at time *t*+1. The total value of stock A at time *t*+1 will be $150 and its weight will be 0.75. Stock B's weight will decrease from 0.5 to 0.25:

$$\text{Total sells} = \$0.\text{Total purchases} = \$100.\text{Average TNA} = \$150.$$

$$\text{PTR} = \$0/\$150 = 0 \text{ while MT} = 1/2 \times (|0.75–0.5| + |0.25–0.5|) = 0.25$$

Scenario 4: decrease existing positions disproportionately (scale-down) because of new net outflows
The fund experiences net outflows of $50 at time *t*+1. The manager sells one share of stock A alone while keeping stock B's holdings constant, because of the new net outflows of $50. Now the total portfolio value will be $50 at time *t*+1. The total value of stock A in the portfolio at time *t*+1 will be $0 and its weight will be 0 as well, while stock B's weight will increase from 0.5 to 1:

$$\text{Total sells} = \$50.\text{Total purchases} = \$0.\text{Average TNA} = \$75.$$

$$\text{PTR} = \$0/\$75 = 0 \text{ while MT} = 1/2 \times (|0–0.5| + |1–0.5|) = 0.5$$

Impact of offsetting trades
Scenario 5: sell an existing holding and buy the same equity holding again
The manager sells one share of stock A and immediately buys back one share of stock A (net inflows/outflows equal zero). Now the total portfolio value will still be $100 at time *t*+1 and the weights in stocks A and B will remain unchanged at 0.5 at time *t*+1:

$$\text{Total sells} = \$500.\text{Total purchases} = \$50. \text{ Average TNA} = \$100.$$

$$\text{PTR} = \$50/\$100 = 0.5 \text{ while MT} = 1/2 \times (|0.5–0.5| + |0.5–0.5|) = 0$$

Special case: impact of holding all cash
Scenario 6: sell all existing holdings and hold all proceeds in cash
The manager sells each share of stock A and B and holds all the proceeds in cash (again net inflows/outflows equals zero). Now the total portfolio value will still be $100 at time *t*+1 but the weights in stocks A and B will be zero and the weight in cash will be 100 percent:

$$\text{Total sells} = \$100.\text{Total purchases} = \$0.\text{Average TNA} = \$100.$$

$$\text{PTR} = \$0/\$100 = 0 \text{ while MT} = 1/2 \times \left(|0–0.5| + |0–0.5| + |1-0|\right) = 1$$

Table AII.
Double sorts on modified turnover, activeness measures and fund characteristics

Panel A

	MT						
Flows	Low	2	3	4	High	All	H-L
Low	−1.47	−2.14**	−1.73	−1.10	−0.86	−1.35	0.61
	(−1.21)	(−2.02)	(−1.30)	(−0.93)	(−0.62)	(−1.39)	(0.50)
2	−0.36	−0.48	−1.34	−0.21	−4.74***	−1.13*	−4.38***
	(−0.41)	(−0.58)	(−1.24)	(−0.16)	(−3.71)	(−1.66)	(−3.09)
3	−0.53	−1.02	−0.63	−1.91*	−2.32*	−0.87	−1.79
	(−0.73)	(−1.31)	(−0.66)	(−1.93)	(−1.68)	(−1.42)	(−1.29)
4	−0.35	−0.43	−0.03	−2.40**	−1.23	−1.24*	−0.88
	(−0.36)	(−0.44)	(−0.03)	(−2.36)	(−0.74)	(−1.77)	(−0.56)
High	−0.98	−2.45**	−2.99***	−1.62	−2.41*	−1.75**	−1.57
	(−0.90)	(−2.12)	(−2.94)	(−1.43)	(−1.85)	(−2.42)	(−1.00)
All	−0.42	−0.95	−1.44**	−1.78**	−2.82**	−1.12**	−2.41**
	(−0.67)	(−1.37)	(−2.14)	(−2.13)	(−2.37)	(−2.02)	(−2.12)
H–L	0.61	−0.45	−1.26	−0.52	−1.55	−0.40	
	(0.35)	(−0.29)	(−0.88)	(−0.35)	(−1.09)	(−0.34)	

	MT						
1 year prior return	Low	2	3	4	High	All	H-L
Low	−1.79	−0.70	−1.27	−2.04	−1.06	−1.48	0.81
	(−1.27)	(−0.49)	(−0.92)	(−1.41)	(−0.76)	(−1.22)	(0.69)
2	−1.33	−0.24	−1.50	−2.21**	−3.89***	−0.96	−2.56*
	(−1.26)	(−0.23)	(−1.16)	(−2.00)	(−3.15)	(−1.09)	(−1.80)
3	0.10	−1.60*	−1.28	−1.37	−3.54***	−0.76	−3.63***
	(0.12)	(−1.85)	(−1.55)	(−1.51)	(−2.74)	(−1.23)	(−3.47)
4	−1.34*	−1.45**	−2.12**	−0.31	−0.40	−1.17*	0.94
	(−1.72)	(−2.14)	(−2.23)	(−0.32)	(−0.31)	(−1.89)	(0.78)
High	0.11	−0.46	−1.17	0.22	−2.25	−0.74	−2.36
	(0.08)	(−0.37)	(−0.93)	(0.17)	(−1.45)	(−0.75)	(−1.59)
All	(−0.42)	−0.95	−1.44**	−1.78**	−2.82**	−1.12**	−2.41**
	−0.67	(−1.37)	(−2.14)	(−2.13)	(−2.37)	(−2.02)	(−2.12)
H-L	2.06	0.24	0.04	2.26	−1.19	0.74	
	(1.00)	(0.13)	(0.02)	(1.30)	(−0.59)	(0.43)	

	MT						
Expense Ratio	Low	2	3	4	High	All	H-L
Low	−0.07	2.39	−0.98	−0.42	−2.71	0.34	−2.64
	(−0.06)	(1.63)	(−0.68)	(−0.28)	(−1.29)	(0.41)	(−0.96)
2	−0.40	−0.39	−0.35	−2.59	−1.56	−0.82	−1.15
	(−0.27)	(−0.21)	(−0.29)	(−1.23)	(−0.78)	(−0.82)	(−0.45)
3	−0.79	−1.08	0.30	−1.48	−1.21	−1.94*	−0.43
	(−0.54)	(−0.56)	(0.18)	(−0.66)	(−0.62)	(−1.89)	(−0.18)
4	−3.33	−0.13	2.35	−1.09	−3.62	−1.55	−0.28
	(−1.54)	(−0.07)	(1.40)	(−0.66)	(−1.60)	(−1.39)	(−0.10)
High	−1.95	0.36	−1.28	−1.56	−3.40	−2.22**	−1.45
	(−1.03)	(0.26)	(−0.45)	(−0.95)	(−1.35)	(−2.21)	(−0.40)
All	−0.42	−0.95	−1.44**	−1.78**	−2.82**	−1.12**	−2.41**
	(−0.67)	(−1.37)	(−2.14)	(−2.13)	(−2.37)	(−2.02)	(−2.12)
H-L	−1.88	−2.03	−0.38	−1.14	−0.69	−2.56***	
	(−1.28)	(−1.23)	(−0.16)	(−0.53)	(−0.48)	(−3.84)	

	MT						
TNA	Low	2	3	4	High	All	H-L
Low	−1.07	−0.24	−1.12	−0.52	−0.82	−0.64	0.25
	(−1.39)	(−0.28)	(−1.57)	(−0.51)	(−0.86)	(−1.09)	(0.21)
2	−0.64	−1.16	−0.21	−0.43	−1.18	−1.09*	−0.44
	(−0.92)	(−1.36)	(−0.23)	(−0.49)	(−1.21)	(−1.70)	(−0.42)
3	−0.45	0.05	−0.48	−0.82	−0.77	−0.90	−0.32
	(−0.50)	(0.07)	(−0.51)	(−0.92)	(−0.68)	(−1.43)	(−0.26)
4	−0.70	−1.31*	−1.46*	−0.63	−2.84***	−1.31**	−2.14*
	(−0.86)	(−1.96)	(−1.80)	(−0.82)	(−2.66)	(−2.07)	(−1.93)
High	0.15	−1.35*	−1.47**	−2.16**	−3.47**	−1.27**	−3.60**
	(0.23)	(−1.80)	(−2.06)	(−2.44)	(−2.42)	(−2.33)	(−2.34)
All	−0.42	−0.95	−1.44**	−1.78**	−2.82**	−1.12**	−2.41**
	(−0.67)	(−1.37)	(−2.14)	(−2.13)	(−2.37)	(−2.02)	(−2.12)
H–L	1.22	−1.11	−0.35	−1.64	−2.79**	−0.63	
	(1.65)	(−1.51)	(−0.41)	(−1.63)	(−2.49)	(−1.55)	

(*continued*)

	MT								MT						
PTR	Low	2	3	4	High	All	H-L	Flow volatility	Low	2	3	4	High	All	H-L
Low	−0.64	−1.49	−0.28	−2.66	−1.29	−0.57	−0.90	Low	−0.76	−0.09	−0.11	−2.03**	−4.14***	−0.86	−3.38**
	(−0.98)	(−1.48)	(−0.25)	(−1.58)	(−0.88)	(−1.15)	(−0.60)		(−1.03)	(−0.12)	(−0.13)	(−2.09)	(−2.95)	(−1.41)	(−2.57)
2	1.07	−0.08	−1.59	−1.71	−2.59*	−0.93	−3.47**	2	−0.48	−1.91**	−1.39	−0.77	−1.77	−1.18**	−1.29
	(1.43)	(−0.10)	(−1.59)	(−1.08)	(−1.73)	(−1.52)	(−2.41)		(−0.50)	(−2.01)	(−1.39)	(−0.69)	(−1.04)	(−2.22)	(−0.69)
3	−2.42*	−1.76*	−1.15	−0.91	−1.12	−1.08	1.62	3	−0.38	−1.79*	−2.85***	−0.41	−1.12	−1.80***	−0.74
	(−1.85)	(−1.91)	(−1.39)	(−1.09)	(−0.93)	(−1.64)	(0.96)		(−0.39)	(−1.78)	(−3.11)	(−0.37)	(−0.88)	(−2.81)	(−0.49)
4	−3.36***	−1.51	−2.22***	−2.19***	−1.90	−1.97***	1.63	4	−0.40	−1.11	−2.39*	−1.79	−2.34*	−1.72**	−2.16
	(−2.77)	(−1.39)	(−3.13)	(−2.77)	(−1.28)	(−2.98)	(0.78)		(−0.38)	(−1.04)	(−1.95)	(−1.65)	(−1.93)	(−2.19)	(−1.43)
High	−3.67	0.36	−1.28	−0.64	−2.96**	−1.88*	1.45	High	1.44	−1.16	−3.40**	−1.75*	−2.13	−1.60**	−3.63*
	(−1.34)	(0.23)	(−1.13)	(−0.58)	(−2.30)	(−1.96)	(0.55)		(1.01)	(−1.10)	(−2.30)	(−1.78)	(−1.31)	(−2.36)	(−1.76)
All	−0.37	−0.72	−1.41**	−1.50*	−3.06***	−1.12**	−2.69**	All	−0.42	−0.95	−1.44**	−1.78**	−2.82**	−1.12**	−2.41**
	(−0.63)	(−1.12)	(−2.19)	(−1.91)	(−2.69)	(−2.02)	(−2.43)		(−0.67)	(−1.37)	(−2.14)	(−2.13)	(−2.37)	(−2.02)	(−2.12)
H-L	−2.92	2.17	−0.63	1.74	−2.12	−1.31		H-L	2.32	−1.07	−3.29**	0.28	2.01	−0.74	
	(−1.05)	(1.32)	(−0.39)	(0.94)	(−1.16)	(−1.57)			(1.61)	(−0.97)	(−2.52)	(0.25)	(1.37)	(−1.17)	

Panel B

	MT								MT						
ICI	Low	2	3	4	High	All	H-L	Active Share	Low	2	3	4	High	All	H-L
Low	−0.71	−1.16**	−1.68***	−1.34	−1.74**	−1.28***	−1.21	Low	−1.34**	−0.07	−0.94	−0.52	−2.53**	−0.91	−1.09
	(−1.40)	(−2.25)	(−3.09)	(−1.65)	(−2.04)	(−3.34)	(−1.33)		(−2.41)	(−0.09)	(−1.35)	(−0.68)	(−2.24)	(−1.50)	(−0.82)
2	−0.99	−0.66	−0.79	−0.80	−3.93***	−0.91	−2.93***	2	−2.24**	−1.37*	−1.63*	−1.48	−1.02	−1.06*	1.27
	(−1.37)	(−0.77)	(−1.06)	(−1.05)	(−3.75)	(−1.58)	(−2.69)		(−2.27)	(−1.73)	(−1.71)	(−1.37)	(−0.77)	(−1.84)	(0.74)
3	−0.67	−1.02	−3.21***	−2.97***	−2.69**	−0.92	−2.03	3	1.14	−0.83	−3.41***	−1.58	−3.36*	−1.37	−4.50**
	(−0.71)	(−1.07)	(−3.09)	(−2.77)	(−2.18)	(−1.35)	(−1.53)		(1.09)	(−0.68)	(−2.83)	(−1.04)	(−1.81)	(−1.51)	(−2.39)
4	−0.12	−1.45	0.04	−1.58	−3.29**	−0.91	−3.17**	4	−1.13	−0.99	−2.53*	−2.26*	−2.71	−1.12	−1.54
	(−0.13)	(−1.31)	(0.04)	(−1.37)	(−2.20)	(−1.10)	(−2.31)		(−0.86)	(−0.65)	(−1.79)	(−1.79)	(−1.61)	(−1.05)	(−0.84)
High	1.50	−1.26	−2.27	−1.01	−1.44	−0.28	−2.94	High	−0.40	−1.20	−0.44	−1.83	−3.49*	−1.06	−3.10
	(1.30)	(−1.10)	(−1.48)	(−0.60)	(−0.78)	(−0.33)	(−1.27)		(−0.21)	(−0.93)	(−0.32)	(−1.19)	(−1.92)	(−1.02)	(−1.63)
All	−0.42	−0.95	−1.44**	−1.78**	−2.82**	−1.12**	−2.41**	All	−0.42	−0.95	−1.44**	−1.78**	−2.82**	−1.12**	−2.41**
	(−0.67)	(−1.37)	(−2.14)	(−2.13)	(−2.37)	(−2.02)	(−2.12)		(−0.67)	(−1.37)	(−2.14)	(−2.13)	(−2.37)	(−2.02)	(−2.12)
H–L	2.24*	−0.10	−0.58	0.32	0.30	1.00		H-L	0.95	−1.13	0.50	−1.31	−0.25	−0.15	
	(1.77)	(−0.09)	(−0.38)	(0.19)	(0.18)	(1.19)			(0.52)	(−0.92)	(0.35)	(−0.85)	(−0.12)	(−0.17)	

(*continued*)

Table AII.

Table AII.

AW	MT Low	2	3	4	High	All	H-L
Low	−1.41	−1.63**	−1.73	−1.96*	−5.29***	−1.71***	−3.92***
	(−1.52)	(−2.12)	(−1.40)	(−1.71)	(−3.75)	(−2.63)	(−2.76)
2	1.12	−1.19	−1.42*	−3.12***	−2.44**	−1.37**	−3.56**
	(1.06)	(−1.64)	(−1.81)	(−2.87)	(−2.02)	(−2.15)	(−2.56)
3	−1.10	−2.17**	−0.54	−1.91**	−3.12**	−1.22*	−1.98
	(−1.16)	(−2.16)	(−0.53)	(−1.97)	(−2.45)	(−1.91)	(−1.53)
4	−0.48	−1.23	−0.68	−1.45	−2.87**	−0.54	−2.38
	(−0.52)	(−1.35)	(−0.85)	(−1.28)	(−1.99)	(−0.88)	(−1.38)
High	0.11	0.36	−1.56	−0.33	−0.63	−0.15	−0.74
	(0.13)	(0.28)	(−1.45)	(−0.28)	(−0.41)	(−0.17)	(−0.46)
All	−0.42	−0.95	−1.44**	−1.78**	−2.82**	−1.12**	−2.41**
	(−0.67)	(−1.37)	(−2.14)	(−2.13)	(−2.37)	(−2.02)	(−2.12)
H-L	1.43	1.99*	0.17	1.63	4.67**	1.57*	
	(1.26)	(1.70)	(0.13)	(1.18)	(2.52)	(1.78)	

R^2	MT Low	2	3	4	High	All	H-L
Low	2.42	−1.86	0.19	−1.62	−2.28	−0.40	−4.70*
	(1.55)	(−1.08)	(0.12)	(−1.15)	(−1.07)	(−0.37)	(−1.87)
2	−1.49	−0.47	−2.39*	−1.62	−3.68**	−0.57	−2.19
	(−1.35)	(−0.41)	(−1.81)	(−1.52)	(−2.42)	(−0.72)	(−1.19)
3	−0.46	−1.40	−0.42	−0.88	−2.14	−0.78	−1.69
	(−0.49)	(−1.41)	(−0.44)	(−0.64)	(−1.63)	(−1.26)	(−1.24)
4	−1.68*	−0.10	−2.91***	−1.03	−3.22***	−1.67**	−1.54
	(−1.68)	(−0.11)	(−3.65)	(−0.99)	(−2.81)	(−2.57)	(−1.07)
High	−1.53**	−0.97	−1.28	−2.62***	−3.21***	−1.21**	−2.08
	(−2.16)	(−1.20)	(−1.58)	(−2.85)	(−2.69)	(−2.55)	(−1.65)
All	−0.42	−0.95	−1.44**	−1.78**	−2.82**	−1.12**	−2.41**
	(−0.67)	(−1.37)	(−2.14)	(−2.13)	(−2.37)	(−2.02)	(−2.12)
H-L	−3.95**	0.89	−1.46	−1.08	−1.05	−0.81	
	(−2.36)	(0.54)	(−0.89)	(−0.67)	(−0.49)	(−0.73)	

RG	MT Low	2	3	4	High	All	H-L
Low	−0.19	−2.28**	−2.66**	−1.65	−1.94	−0.66	−1.75
	(−0.20)	(−2.09)	(−2.23)	(−1.36)	(−1.28)	(−0.80)	(−1.14)
2	−0.16	−0.80	0.07	−2.39**	−3.57**	−0.88	−3.41**
	(−0.16)	(−0.72)	(0.07)	(−2.20)	(−2.39)	(−1.23)	(−2.32)
3	−0.73	−0.80	−1.11	−0.42	−2.07	−1.05*	−1.32
	(−0.81)	(−0.78)	(−0.98)	(−0.35)	(−1.30)	(−1.77)	(−0.82)
4	−1.84	−1.22	−2.36**	−0.37	−1.35	−0.50	0.49
	(−1.58)	(−1.05)	(−2.07)	(−0.29)	(−1.11)	(−0.70)	(0.31)
High	−0.34	0.25	−3.83***	−2.18*	−3.12*	−1.23	−3.21
	(−0.22)	(0.19)	(−3.02)	(−1.76)	(−1.95)	(−1.45)	(−1.59)
All	−0.42	−0.95	−1.44**	−1.78**	−2.82**	−1.12**	−2.41**
	(−0.67)	(−1.37)	(−2.14)	(−2.13)	(−2.37)	(−2.02)	(−2.12)
H-L	−0.33	2.81**	−1.07	−0.53	−1.18	−0.57	
	(−0.20)	(2.02)	(−0.72)	(−0.36)	(−0.80)	(−0.73)	

Notes: Table AI displays risk-adjusted returns (annualized and in percentages) net of fees, and *t*-statistics (in parentheses), for fund groups sorted by modified turnover (MT) and by each of the following fund characteristics in Panel A: flows, return_12m, expense ratio, TNA, portfolio turnover ratio (PTR) and flow_volatility_12m and by each of the following activeness measures in Panel B: industry concentration index (ICI), Active Share (AS), Active Weight (AW), R^2 and Return Gap (RG). Each quarter, funds are assigned to one of (5×5) portfolios according to MT and fund characteristic (an activeness measure, in Panel B). Then, we save the fund's return over the next three months, compute the TNA-weighted returns of these portfolios and run monthly regressions of excess returns on the four Carhart factors using the full sample period. The bottom two rows display the difference in α's between the top and bottom MT-sorted quintiles for each fund characteristic (activeness measure, in Panel B) group, and the (Newey-West) *t*-statistic for this difference. *,**,***Significant at 10, 5 and 1 percent levels, respectively