Imitation is the sincerest form of flattery: fund manager stock picking skill and the skill of copycat managers to pick good stock pickers

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We introduce a measure to quantify copycat activity, that is, mutual fund managers that imitate the disclosed holdings of other managers. We analyze a large sample of U.S. equity funds and find that this activity is pervasive, although the intensity in which individual managers engage in it varies. For further analysis we group funds into those that mimic other funds the most, and call them Followers, and those that are imitated the most, and label them Leaders. Unlike most previously reported results, Followers do not outperform the average mutual fund, and neither do the Leaders. However, mimicking portfolios constructed by imitating only these Leader funds do outperform the market and their peers, with annualized four factor alphas of 2.5%. Further tests show that this performance is not attained by following past winner funds or stocks. This hints at the possibilities of a new form of fund manager skill: that of identifying Leaders whose portfolio disclosure reports contain valuable information and are worth mimicking.

**JEL classifications:** G11, G14, G23,

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1. Introduction

As of 2013, there are 8,752 open-ended mutual funds in the U.S. with combined assets of more than $13 trillion\(^1\), 33% of which is invested in U.S. firms’ equity. With the average fee charged by actively managed mutual funds being close to 1% of assets under management, these funds collectively receive revenues of close to $430 billion from their investors. And yet, there’s an enormous amount of evidence that active fund managers rarely outperform their risk-based benchmark (Jensen (1968), Malkiel (1995), Fama and French (2010), and others) net of fees. However, while as a whole the mutual fund industry does not generate excess returns above their benchmark, there is evidence that a small sample of actively rebalanced funds do earn positive excess returns (see, for example, Avramov and Wermers (2006), Kosowski, Timmerman, Wermers and White (2006), Cuthbertson, Nitzsche and O’Sullivan (2008)). These disparate threads of empirical evidence motivates this paper in the following context. First if skillful managers exist then how can we identify them? Second, is their skill persistent? Finally, does the identification of the skillful manager translate into higher excess returns for the investor?

Across a large sample, we identify those funds that are most imitated by their peers using the mandated holdings’ disclosure (see for example, Phillips, et al., 2014). Using the disclosed holdings and a novel measure to quantify copycat activity (Verbeek and Wang (2013), and Frank et al. (2004)), we rank the funds into those which imitate others the most, which we label “followers”, and those which are most imitated, which we term “leaders”. Mimicking the leader funds’ holdings, we generate an investment strategy that earns 2.5% annual alpha, net of trading costs.

This paper is most closely related to studies of ‘copycat funds’ such as Frank, Poterba, Shackelford and Shoven (2004) (henceforth FPSS), Verbeek and Wang (2013) (henceforth VW) and Phillips, Pukthuanthong and Rau (2014) (henceforth PPR). Both FPSS and VW use the lagged portfolios holding disclosures to generate mimicking portfolios. However, FPSS examine only a subset of mutual funds and argue that actively managed funds generate higher fees that presumably leads to superior performance. Using this fee structure to identify the superior funds, whose holdings would most likely be mimicked by peer funds, they find no superior performance. VM generate mimicking funds for the whole sample of mutual funds, making their aggregate performance no different than the market. In both cases, there is no real identification of funds that actually engage in copycat trading. Our study analyzes the universe of mutual funds and develops a model to specifically identify those funds that yield the highest benefit from mimicking.

Our copycat measure is based on trades inferred for each fund’s portfolio holdings by the difference in their quarterly reported number of shares held. Using a five year window of data rolled at quarterly frequency, we first estimate a vector of stock trades for each stock in each fund. We then estimate a VAR model using every single pairwise combination of two funds trading the same stock across all open-ended mutual funds\(^2\), where the dependent variables are each fund’s contemporary trades of the stock, and the regressors are the one-quarter lagged trades. Using the output from each VAR model we then run Granger causality tests in two directions. We maintain a running total of instances of funds following each other’s trades. So, for every significant Granger statistic we obtain, we add one “follower” count to the fund that is identified as imitating trades, and one to the “leader” count of the fund being imitated. Finally, for each mutual fund in

\(^2\) For each quarter, the estimation procedure requires estimating 40 to 50 million regressions.
the sample, the copycat measure is calculated as the leader count minus the follower count, and divided by its total number of stocks. For each five year rolling-window of data every fund’s copycat measure is ranked monotonically. We label funds with high copycat measure as “Leaders” and those with a low copycat measure as “Followers”.

PPR introduce a different methodology to identify copycat funds. However, their measure relies on comparing the trades of two funds in a single sequence of adjacent quarters. That is, a fund’s trades inferred for one quarter are compared to those obtained from a different fund the preceding quarter. A matching trade is defined as one made by both funds for the same stock in subsequent periods. If the funds match trades for more than a predefined threshold number of stocks (for example, 90%), then the fund that trades in the contemporary quarter is labeled as a copycat. While logically sound, this approach restricts the analysis in two important ways. First, it looks at a single period of imitating behavior, which increases the probability of a spurious signal. Second, as is the case in FPSS and VW, copycatting is viewed as a one-to-one relationship between two funds, when it could also be the case that an imitator might be following the portfolio disclosures of more than one fund. Our methodology uses a time series approach and statistical testing to greatly reduce the probability of false positives. Moreover, analyzing copycat behavior at the stock level not only relaxes the fund-level restriction, it also allows the resulting measure to be a continuous scale of the intensity of copycat activity, as opposed to a simpler binary result.

We believe that our focus on the time-series of holdings rather than the cross-sectional relation in the holdings as advocated by PPR greatly adds to the power of our tests and in the determination of those funds that exhibit superior performance.
Using our time-series copycat measure we rank our sample of funds into Leaders and Followers each quarter. We find that both of these groups contain funds that are smaller than the average mutual fund in terms of net assets and exhibit higher volatility in their capital allocation to common stocks as well as higher turnover rates, both of which are indications of active fund management. Following VW, we generate a mimicking portfolio each quarter across all funds in the sample and average their monthly performance according to our previously identified groups, those portfolios that mimic Leader and Follower funds. We deduct trading costs estimated at the stock trade level by subtracting the full bid-ask spread every time there is a ‘buy’ signal as we rebalance each mimicking portfolio.

We find that a strategy that mimics the Leader funds outperforms the mimicking portfolios of all other funds. On a net of trading costs return basis, Leaders outperform all other funds by a statistically significant 28 basis points per month (3.36% annualized return), and outperform the market portfolio by a statistically significant 40 basis points per month (4.80% annualized return). The strategy of mimicking the holdings of all Leader funds generates a four-factor model annual alpha of about 2.5% per year. As a robustness check, restricting the holdings that are allowed to be mimicked, for instance using only the 25% top holdings in each mimicked fund, the annual alpha increases to 4.7%. Interestingly, the significance of the risk-adjusted returns is not evident for the Follower funds. These results indicate that more properly modeling Leaders and Followers in fund activity better identifies those funds that exhibit some stock selectivity advantages. Taken further, mimicking those funds that exhibit stock selectivity skill, yields superior risk-adjusted and fee adjusted returns. This finding is contrary to that asserted by (FPSS and PPR) who find no
significant in the performance of copycat funds. It must be stressed that this information pertains not only to stock selection, but also to asset allocation so that the core stocks, i.e. those to which a fund manager allocates higher proportions of his capital, have the most valuable information.

Our copycat measure seems able to capture various dimensions of fund manager skill. This ties our research to the nascent literature on manager skill, such as Kosowski, Timmerman, Wermers and White (2006), Cuthbertson, Nitzsche and O’Sullivan (2008), and Silli (2006). One of the measures introduced to identify superior skill is Amihud and Goyenko’s R-squared, which uses this statistic to gauge how much a manager’s strategy diverges from a passive investment in the market portfolio. We test whether the R-squared measure is useful in identifying fund managers with superior information by using it to rank mutual funds instead of our copycat measure, and then analyze the performance of the mimicking portfolios generated for the higher and lower ranked groups of funds. Amihud et al predict that funds with a lower R-squared measure will tend to have superior performance. However, while the mimicking portfolios of these lower R-squared funds seem to have a higher level of performance than other portfolios in the sample, they are not able to generate positive and significant alphas as those based on the higher scores in the copycat measure scale, the Leaders.

To further illustrate the importance of our model, and to further link to previous measures of fund manager skill, we study the performance of the mutual funds in our sample, grouped into the Leader and Follower categories. We find that actual mutual funds labeled as Leaders show no evidence of outperforming their peers nor the market index. While this result invalidates approaches based on the funds’ track record, it raises the question of whether these Leaders do
have any special skill. Using a natural experiment, we investigate the reactions of Leaders and Followers to the recent financial crisis of 2008 in a difference-in-difference setting and using dummy variables to indicate the span of the “Great Recession” as identified by the NBER\(^3\). We find that all fund managers seem equally surprised by the onset of the crisis, with no performance advantage evident in any group. However, Leader funds recover significantly faster than the average mutual fund, while Follower funds do not demonstrate any significance in the recovery compared to the rest of the mutual funds.

Taken together, our results are consistent with the literature that studies skill in active fund management and finds that a relatively small subset of managers do seem to possess superior skill. However, previous measures (Kosowski et. al. (2006), Cremers and Petajisto (2009), Kacperczyk, Sialm and Zheng (2008), and others) of skill are not as effective at identifying skill as our measure. We show that any investor could make use of our methodology to invest in a long only portfolio with low trading costs and still obtain a robust, statistically and economically significant alpha. The implication for regulators is that it shows that the information contained in holdings disclosures have value, and piggy-backing on these disclosed holdings imposes a performance penalty on those fund managers that develop the information.

The model and the results of this paper also shed light on more informed segments of the market. We often use institutional holdings as a measure of informed trading in a stock for investment analysis (see for example Nofsinger and Sias (1999), Sias, Starks and Titman (2001), Boehmer

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\(^3\) It may be argued that recessions, per se, are not exogenous shocks because they can be anticipated. The Great Recession that spanned May, 2007 to December 2008 was unprecedented in scope and severity. It is of little doubt that this recession was unpredictable and hence truly exogenous.
and Kelley (2009), Yan and Zhang (2009)). This assumption appears to be severely questioned by our results. We conclusively show that only Leader funds are informed as dictated by their superior performance. Our measure can be used to identify those funds that are truly informed and examining the holdings of these funds we can better establish the percentage of informed trade for a particular stock. One dimension of informed trading or superior skill is related to the time varying nature of this skill, as shown in Kacperczyk et. al. (2014), and evidence of market timing skill, as in Mamaysky, Spiegel, and Zhang (2008), Bollen and Busse (2001) and others. Our evidence of Leader performance around the recent economic crisis is consistent with these ideas.

Previous studies have tried to identify funds with superior information by using exogenous information, be it returns or factor model alphas (Elton et al (1996), Carhart (1997)), past inflows (Gruber (1996), Zheng (1999)), and/or fund manager characteristics, like education (Chevalier and Ellison (1999)). Newer approaches include the level of trading activity of the manager as in the Active Share measure introduced by Cremers and Petajisto (2009), the level in which the variability of a market index explains that of a fund’s returns, such as the $R^2$ measure of Amihud and Goyenko (2013), or the separation of skill from luck in past performance (Kosowski et. al. (2006), Stein (2014)). We, however, model this endogenously noting that copycat fund managers themselves provide a signal through their mimicking asset trades of those leader funds. The costly signal of the copycats is an indication of each peer fund’s appraisal of which fund(s) have superior information and for which stocks it is concentrated.
The rest of this paper is organized as follows. Section 2 described the copycat measure model and the methodology and data used to estimate it. Section 3 presents our main results and robustness tests, and Section 4 concludes.
2. Sample and Methodology

Data used in this study comes from three sources: mutual fund characteristics from the CRSP Survivor-Bias-Free U.S. Mutual Fund database, Thompson Financial CDA/Spectrum S12 equity holding data\(^4\), and CRSP dataset of stock prices and returns. We use the WRDS MFLINKS database (maintained by Russ Wermers and WRDS) to merge these datasets and obtain a full database of mutual fund holdings, their returns and characteristics, and individual stock returns. Our sample of U.S. mutual fund holdings span the period between January 1995 and December 2013. We apply to our database the same filters detailed in VW\(^5\). In brief, we focus on open-ended actively managed U.S. equity mutual funds. We eliminate from the sample funds with equity portfolio holdings below 80% (and above 105%) of the fund’s total value, as well as index funds, international and sector funds. We also address the incubation bias (Elton et. al. (2001), Evans (2010)) by excluding observations prior to the reported fund inception date, as well as funds whose assets fall below $ 5 million.

*The Copycat Measure*

Our measure is based on the following intuition. If a fund buys/sells a stock in one quarter and then in the subsequent quarter another fund buys/sells the same stock, then we can test whether one fund’s trades is precedent in that stock. Additionally, if this behavior is persistent over time, then we can establish a time-series pattern that is statistically defined. Thus if there is a Leader

\(^4\) A previous version of this paper uses portfolio holdings obtained from CRSP. This dataset presents a few shortcomings compared to the one from Thompson. The amount of data is lower, as it contains holdings starting in the year 2000. Also, the CRSP portfolio-to-fund mapping is imprecise, making matching portfolio holdings to fund performance and characteristics measures more difficult. However, all results obtained using CRSP data are qualitatively the same as the ones presented in this version of the paper.

\(^5\) Appendix A in their paper.
funds and a Follower fund, then what we would observe in terms of their trades is that every time the Leader buys/sells a stock, the Follower will tend to buy/sell that same stock in the following period.

This intuition leads to the study of the time-series of trades of each stock held in common by each pair of mutual fund. We specify a model in which the contemporary quarter’s trades of stock Z by fund X will be explained by the preceding quarterly trades of the same stock by fund X and fund Y. However, since we are agnostic on the a priori direction of this relationship, we also consider that it could be fund Y’s trades being explained by the previous activity of fund X. This leads naturally to a VAR model setting, such as

$$y_t^z = x_{t-1}^z + y_{t-1}^z + \epsilon_t$$

(1)

$$x_t^z = x_{t-1}^z + y_{t-1}^z + \epsilon_t$$

The model uses a single lag of fund trades as the explanatory variable. Tests using model fitting algorithms such as the information criteria of Akaike (1973), Schwarz (1978) and Hannan-Quinn (1979) to gauge the quality of the proposed models show this to be the best specification. This is consistent with the intuition that copycat fund managers would use the most recently available portfolio holdings information obtained from other managers to guide their own trade, and thus we would expect older information (further lags) to be of little use in explaining contemporary trades.

For each fund, trades are inferred from changes in the number of shares between portfolio holding reports. All inferred trades data is scaled by the initial number of shares for each position. Scaling
is performed so that the resulting time series of stock trades is expressed as a percentage of the size of the initial position in each security. This ensures that the measures incorporates the relative importance of the trade within each fund. Thus, for example, a trade where 10 shares are bought would be of relatively low importance if the fund that trades that stock previously had a position of 1000 shares in that same stock (which would represent a 1% change in the fund’s position), as opposed to the same trade relative to an initial position of 10 shares (which would be registered as a change of 100%).

We then use a Granger causality test to discern if one fund’s trades influence another fund’s trades. This can be stated as: Does fund x’s holding of stock Z at time t-1 Granger cause fund y’s holding of stock Z at time t. Granger causality tests allow for inferences whether one time series variable can be used to predict another, it is useful to test the relevant question, which is “does fund X tend to follow the trades of fund Y?”

This process generates a vector of Granger test statistics applicable to each of the holdings. However, we are only interested in analyzing those results where the null hypothesis, that there is no relationship between one fund manager’s trades and another’s, is rejected. Thus, we only keep observations for which the Granger test statistic is significant at least at the 10% level\(^6\). We then aggregate the data by adding the number of times the test is rejected for each fund, on both sides of the VAR equations, showing how many times a fund tends to lead or follow other funds in its trades. Finally, we generate the copycat measure. For each fund and each quarter, this measure is equal to the number of stocks in which the fund seems to lead (or is imitated by others) minus the

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\(^6\) Most Granger tests that reject the null do so with infinitesimal p-values. Thus, restricting our data to higher levels of statistical significance does not alter the results in any meaningful way.
number of stocks in which it follows others’ trades, scaled by the total number of stocks in the fund’s portfolio:

\[
\text{Copycat}_{f,t} = \frac{\# \text{stocks lead}_{f,t} - \# \text{stocks copy}_{f,t}}{\# \text{total stocks in portfolio}_{f,t}}
\]  

(2)

, where \( f \) is the fund identifier and \( t \) is the year/quarter immediately following the end of the estimation data window.

To illustrate how data is aggregated into the copycat measure, consider two funds, A and B, both with 10 stocks. As shows in the left side of Image 1, they share positions in only 8 of these assets. The arrows illustrate the direction of the Granger tests based on the time series vectors of trades of each fund in each of the assets they hold in common. Thus, we can see that fund A follows fund B in trades of Stock 1, but the opposite is true for Stock 2. In Stock 3 the test shows causality in both directions. This is not a problem, since as we’ll see these tests just cancel out in the copycat measure and are therefore no different from a case in which there is no Granger causality detected, as for example in stock 4. In the table on the right side of Image 1 we count each stock in which each fund leads, follows or does neither by adding 1 per instance. Then, at the bottom of the table, add the number of stocks in which each fund leads and follows the other fund. As we can see, in this case fund A leads in 2 stocks and follows in 5 of them. Since in this example there are only two funds, the exact opposite is true for fund B. These symmetry need not be the case when analyzing real data, as funds will lead and follow a number of other funds. Finally, we can calculate the copycat measure for each fund using these counts and equation (2), resulting in -0.3 and 0.3 for funds A and B respectively.

[Image 1 here]
The assumptions behind the mimicking portfolios used in FPSS and VW (as well as the measure to identify copycats introduced in PPR) tend to paint a black and white picture with regards to the copycat phenomena. A fund manager either leads, that is, no evidence of imitation behavior can be observed in her trades, or copies, in which case there is no evidence of being followed by others. While this scenario would be ideal for the purposes of analysis, this is not what we find in the data. In fact, the individual components of the measure, the propensity to lead and to follow, are almost invariably positive for all funds. Figure II shows the probability density of the copycat measure for the full sample of funds. As we can see, most of the sample is clustered close to zero, meaning that these funds are engaging in leading and following at almost the same level.

[Figure II here]

To obtain a time series of the copycat measure, we use a 5 year window of data starting in late 1994\(^7\), and roll it forward at quarterly intervals. Thus, the first copycat measure obtained corresponds to Q3 1999 and our last measure is Q4 2013.

Subsamples of funds and mimicking portfolios

One goal of this paper is to analyze funds identified as either net Leaders or Followers. In order to do so, and to contrast their performance and characteristics with those of funds that show no such behavior, we generate subsamples by splitting the full sample of mutual funds into groups based

\(^7\) The measure can be estimated with data prior to this date. However, the density of data in the 1980s and most of the 1990s is very low due to both, the lower number of funds in the market, as well as the reduced mandated reporting frequency. Thus, the value is the resulting measure is close to zero in determining Leader and Follower funds, and we therefore restrict our sample to posterior dates.
on the copycat measure of each individual fund. Each quarter we take the funds with the highest 5% copycat measure and label them ‘Leaders’, as these funds exhibit a large propensity to lead other funds in quarterly trades. Likewise, the bottom 5% copycat measure funds we label ‘Followers’. Finally, in some tests we also analyze the sample of funds with a copycat measure of exactly zero (and call them ‘Zeros’). As this last is a fixed condition and not based on a percentage of the sample, the size of this sample varies and, given the distribution seen in the copycat data, tends to be larger than the Leader and Follower samples. This grouping is updated at quarterly intervals, as changes in the quarterly estimated copycat measure make it possible for funds to move from one group to another, as well as to enter or leave the sample.

We also wish to analyze the potential performance of portfolios that mimic the holdings of the funds in our sample. As in FPSS and VW, we assume that portfolio holding disclosures can be obtained with a 60 day delay with respect to the closing date of the reporting period, and so we use that lag before investing in these holdings. Also, as in VW, we generate mimicking portfolios for each fund in the full sample of mutual funds. However, we focus our analysis in comparing the performance of imitating all the funds, as in VW, versus an approach focused on only mimicking the holdings of our previously identified groups, that is, Leaders, Followers and Zeros. Finally, we do not assume a certain fixed level of expenses for our mimicking portfolios. Some of the features observed in our subsamples include variations in trading behavior, most noticeably in portfolio turnover and relative liquidity of assets traded. Both of these characteristics have important effects on trading costs, and we wish to preserve these features when analyzing the potential performance.

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8 In non-reported robustness tests we change the percentages that define these groups. Although all results reported are based on 5% tail groups, for a broad range from between 2% and 17% we obtain very similar results.
of mimicking each portfolio. Thus, we obtain TAQ data\(^9\) of the full bid-ask spreads for all stocks in our funds’ holdings. In generating the mimicking portfolios, whenever there is a stock ‘buy’ trade we assign to it a trading cost equivalent to the full spread of the stock, times the percentage change in the portfolio’s position in that stock, times the current portfolio weight. This simulates the round-trip cost of buying and then selling that precise number of shares, in terms of the impact (or contribution) to overall portfolio trading costs.

Thus, throughout this paper we analyze two distinct sets of samples: those of mutual funds, with data obtained from the CRSP tape, and those of mimicking portfolios. For each set, we contrast the performance and characteristics of the full sample, versus the groups labeled as ‘Leaders’, ‘Followers’ and ‘Zeros’.

\(^9\) All results presented in this paper regarding mimicking portfolios use TAQ data. However, for robustness we also test CRSP spreads. Results are unchanged.
3. Data Analysis and Empirical Results

Descriptive Statistics of the Samples of Mutual Funds

Using our definition for ‘Leader’ and ‘Follower’ funds, we compare characteristics of these two groups to each other, as well as to the average fund of the full sample, labeled ‘All Funds’. Table I contains the summary statistics for these characteristics.

In Panel A of Table I we see the data for the full time series of yearly CRSP Mutual Fund characteristics, spanning the period 1999:12 – 2013:12. While the size of the Leader and Follower fund, in terms of Total Net Assets (TNA), is far smaller than the average mutual fund (386 M$ for Leaders, vs. 825 M$ for All Funds), their level of trading activity seems to be somewhat higher, as depicted in both, the turnover ratio (0.943 for Leaders and 0.869 for All Funds), and the standard deviation of the percentage of the fund’s capital invested in common stock, Per. Com. (9.405 for Leaders; 8.802 for All Funds). While these last two characteristics are different but perhaps not significantly so, they do seem to show that Leaders and Followers trade more actively than the rest of the sample. Finally, Leaders and Followers tend to have smaller portfolios in terms of number of stocks, as well as the average market cap of these stocks and their market prices. Summing up, at this point we seem to have two groups of mutual funds, Leaders and Followers, which are similar to each other but different to the rest of the funds in the full sample, in ways that indicate smaller, more nimble and active fund management.

In 2004 the SEC changed the reporting requirement of portfolio holdings for mutual funds from semiannual to quarterly. All current copycat fund literature points to this event as an important
milestone, in that the added information being disclosed to the market might have caused copycat funds to become more successful in imitating others, and thus this style of fund management might have become more common. Panels B and C in Table I show the same statistics portrayed in Panel A, but for samples of data observed before and after 2004. Some differences are simple consequences of the growth in the mutual fund market, like the larger number of funds and assets under management in the second period. Thus, we have that all groups in Panel C have higher average TNA and number of funds. However, there is one variable that might be consistent with the increases copycat activity speculation, and that is the standard deviation of Per. Com. While this statistic is larger in Panel C than in Panel B for all groups, the growth in volatility in the sample of All Funds is around 40% and for Leaders is only 11%, whereas for Followers the increase is above 100%. However, it is not entirely clear that this increase in volatility of stock investments is due entirely to a copycat activity increase after the 2004 regulation change. In Panels D and E we contrast the statistics for periods before and after the onset of the 2008 economic crisis, and see that the increase in the standard deviation of Per. Com. remains almost the same as in the previous panels.

Performance of Mimicking Portfolios of Mutual Funds

As described in the previous section, we generate portfolios by following the holdings disclosures of every mutual fund in the sample. We assume a 60 day lag between the closing of the reporting period, and the date in which the data becomes available. We then configure portfolios that contain the same stocks and portfolio weights as each fund in the sample. Individual portfolio weights for each fund are calculated as
\[
    w_{i,t} = \frac{n_{i,t}P_{i,t}}{\sum_{i=1}^{N} n_{i,t}P_{i,t}}
\]

where \( n_{i,t} \) is the number of shares of stock \( i \) held at time \( t \), and \( P_{i,t} \) is the price of the stock at the time the weights are calculated. Unlike some previous researchers, we exclude all non-equity investments from these portfolios. To that effect, we normalize portfolio weights to reflect 100\% of the invested capital. Since the funds in the sample were already selected to have a large percentage of their capital invested in common stock, and since we are interested in the potential information value of these disclosures in terms of equity investments, we do not believe this practice introduces any noticeable bias in the empirical tests. We then calculate portfolio returns as

\[
    R_{i,t} = \sum_{l=1}^{N} w_{i,t} r_{i,t}
\]

where \( r_{i,t} \) is the return of stock \( i \) at time \( t \). Finally, we deduct trading costs in the form of TAQ bid-ask spreads\(^{10} \), accrued on every ‘buy’ generated by positive changes in the number of shares held by an imitated fund.

Once we have a time series of portfolio returns for mimicking portfolios of all mutual funds in our sample, we proceed to take the average for each group and so analyze the performance of the full sample of mimicking portfolios, as well as the samples of Leaders, Followers and, in some cases, Zeros.

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\(^{10} \text{We also run all tests using CRSP bid-ask spreads. Results are unchanged.} \)
Panel A of Table II contains standard investment performance measures commonly used in the industry applied to each set of funds, including holding period returns, mean monthly returns, standard deviation and Sharpe ratios. The same statistics are applied to the market index (obtained from Kenneth French’s web site, along with factor data for factor model regression) for comparison. The first surprise is that, contrary to most tests on mutual funds, all samples of mimicking portfolios seem to outperform the market. Since these mimicking portfolios have far lower turnover rates and expenses than their mutual fund counterparts, this first result seems to bolster the theory that, on average, mutual funds do outperform the market, but only in terms of returns gross of trading costs and other expenses. Once these expenses are factored in, the resulting performance for the fund investor tends to lag the market. Even controlling for the average performance of all mimicking portfolios, we see that Leaders and Followers are far better investments than the rest of the sample, though very similar to each other. This is confirmed in Panel B, where paired, two-tailed T-tests are used to compare the returns of each group. While Leaders and Followers are significantly superior to the other samples, Leaders seem to be better than Followers but the difference is not statistically significant.

[TABLE II HERE]

We test the capacity of the copycat measure to predict future performance. Table III shows the results of a two-way sort of sample returns, net of trading costs. One quarter’s copycat measure is used to group the following quarter’s returns into those of Leaders, Followers and Zeros. The subsequent quarter returns are then sorted into quintiles. The last two columns show the difference in net returns between Leaders and Zeros (LMZ) and between Followers and Zeros (FMZ). As we
can see in the LMZ column, the contemporary copycat measure does tend to predict higher levels of return for the Leader funds than for the Zeros in most return quintiles (three out of five quintile differences are statistically significant). The effect, while similar, is less pronounced for the Followers, as the pattern in the FMZ column is the same, but only one datum is statistically significant.

[TABLE III HERE]

Next we turn to multivariate factor models to test the performance of each sample of mimicking portfolio, controlling for common sources of risk. We use the standard Carhart (1997) four factor model, which controls for firm size, book-to-market ratio and price momentum. In models (1) to (4) of Table IV we regress each sample’s time series of net excess returns\(^\text{11}\) on the four factors, and examine the resulting alpha in search of evidence of outperformance. The results on Table IV show that the factor model alpha is only positive and significant for the sample of portfolios that mimic the Leaders (model 4). In other words, a strategy based in using the copycat measure to identify Leader funds and imitate their portfolio holdings beats the market, over a long period of time, yielding an annualized alpha of 2.4\%. Moreover, this model attains this level of performance without resorting to short selling with all the costs and restrictions associated, a much debated issue in all strategies that exploit a supposedly identified market anomaly using a long-short hedge strategy. Since we observe that the alpha of funds that mimic the Zeros sample is negative, we also explore the potential for a hedge fund, long in the Leaders and short in the Zeros. Model (5) shows that this strategy also yields a positive and significant alpha, while reducing the exposure to most

\(^{11}\) From gross returns we deduct trading costs as well as the monthly risk-free rate.
risk factors by at least an order of magnitude. This is not so for other hedge experiments where the long position is taken in other sample of funds, including those that mimic the Followers.

TABLE IV HERE

Next we test alternative ways to generate the mimicking portfolios. Table V replicates the factor model regressions from Table IV, but using the returns generated by these alternative specifications for the portfolios. The first empirical question is whether the ‘skill’ or informational value of holding disclosures that drives the results for the Leaders in Table IV can be attributed to stock picking only, or does asset allocation play a role as well. To that effect, we generate a full sample of mimicking portfolios where, instead of using the imitated fund’s portfolio weights, we do equal weighted portfolios. Models (1) and (2) contain the regression results for the Leader and Follower samples of equal weighted portfolios. As we can see, while the alpha for Followers is similar to that obtained in the previous table (positive but insignificant), the advantage of mimicking Leader funds disappears (alpha is negative and insignificant). Thus, it is clear that the disclosed holdings convey information not just of stock picks, but of the relative importance of these selections to the respective fund managers, in terms of their portfolio weights. We further test this notion by generating ‘restricted’ mimicking portfolios and regressing their returns on the four factor model. The restriction refers to using the most important stocks in each mutual fund to build the mimicking portfolios, as depicted by their larger portfolio weights. To do this, we rank each set of quarterly fund holdings in terms of its portfolio weights, then add stocks to the mimicking portfolio, starting with the one with the highest portfolio weight, until we use a certain percentage of the complete fund. Finally, we once again normalize portfolio weights for the
mimicking portfolio, so that even using fewer stocks we still simulate 100% of capital invested. Thus, in models (3) and (4) we use the top 75% of stocks, by weight. In models (5) and (6) we restrict the portfolios to the top 50% holdings of the mutual fund being imitated, and in models (7) and (8) we restrict them to the top 25% holdings. The results again don’t change much for the portfolios that mimic Follower funds. However, for those imitating Leaders the results show a clear pattern of increased alpha as we further restrict the portfolios to smaller number of stocks with higher portfolio weights in their original fund. This pattern is consistent with the notion that a mutual fund is composed of ‘core’ securities, which the fund manager overweights as he has more information about their future prospects, and a number of other securities which are added to the fund to provide diversification or other qualities, but are not part of this core. As we can see in Table V, it would seem that it is these ‘core’ stocks that add the most value to the fund, and from which a theoretical copycat investor could glean the most valuable information to guide his investments.

[TABLE V HERE]

*Can these results be replicated with other measures?*

There is an abundance of measures that purport to predict mutual fund performance. If so, using these measures to identify ‘Leaders’ and then imitate their portfolio holdings should lead to mimicking portfolios which perform in ways at least comparable to those based on the copycat measure presented in this paper. However, that does not seem to be the case.
The measure closest to our own is that presented in Philips et. al., who track mutual fund trades in a similar fashion as we do with our copycat measure. However, while we aggregate the imitation data of a large number of funds to make crowd-based selections of Leaders, their approach is to try to pair a single Follower to a single Leader via similarities in their trade patterns. With this methodology they purport to identify a certain number of copycat funds. Their conclusions are consistent with ours in that real mutual funds that engage in this imitation strategy do not outperform the market or their peers.

Other novel measures that supposedly predict mutual fund performance include Cremers and Petajisto’s (2009) ‘Active Share’, and Amihud and Goyenko’s (2013) $R^2$. We wish to test whether an imitation strategy based on any of these measures would be as successful as one based on our copycat measure. To that effect, we again use mimicking portfolios for the full sample of mutual funds in our dataset, but group them according to an alternate measure and test the performance of the resulting portfolios. In Amihud and Goyenko’s paper they test their measure against that of Cremers and Petajisto’s, and find theirs to be superior. We thus use the $R^2$ measure for our experiment, and assume the results hold for ‘Active Share’. Table VI shows the factor model regressions of net excess returns of mimicking portfolios averaging the full sample (‘All Funds’), as well as those with an $R^2$ measure in the bottom 5% of the sample (‘Low $R^2$’) and those in the top 5% (‘High $R^2$’). Amihud et. al. predict that, on average, mutual funds with a low/high $R^2$ will tend to have a high/low level of performance. While this predicted pattern seems to be borne out in the alphas in Table VI, where the alphas for All Funds, Low $R^2$ and High $R^2$ are -0.1%, 0.05% and -0.03%, none of these coefficients are statistically significant. We run further tests changing the size of each group, using various percentages instead of 5% ranging from 2% to 20%, and the
results remain unchanged. In short, strategies that use the $R^2$ measure to form mimicking portfolios do not outperform, while those that are guided by the copycat measure do.

**[TABLE VI HERE]**

*Can the performance of mimicking portfolios be traced to sources other than the copycat measure?*

Seeing the alphas in tables IV and V it is natural to wonder whether these results are driven by the usefulness of information included in mutual fund portfolio holding disclosures, as parsed using the methodology of the copycat measure, or if some other, previously known factor, lies at the base of these successful investment strategies.

One reasonable argument would be that a mimicking portfolio is nothing more than an elaborate way to invest in a momentum strategy. Imitators invest in stocks that have done well in the past, and thus their performance would align with that of mutual fund managers which invested in the same securities first. However, the factor loading in the Leader regression (model 3) of Table IV is negative and significant, indicating that, if anything, this is a contrarian strategy. While it is true that the opposite can be seen in the restricted portfolio regressions of Table V, the magnitude of these factor loadings is relatively small, so it is difficult to ascribe the full value of the strategy’s performance to momentum.

Another argument would be in the form of mutual fund momentum. That is, simply following a fund that outperforms. Tables VII and VIII show performance metrics and factor model regression results using returns of mutual funds obtained from CRSP. Consistent with most prevailing
literature in the performance of active portfolio management, the long term performance of mutual funds lags the market, even those funds that are labeled as Leaders and Followers. These last two groups show some signs of superior performance in the univariate statistics contained in Panel A of Table VII, however t-tests in Panel B of the same table show that they are not significantly superior, and all alphas in Table VIII are negative and insignificant.

Nevertheless, we do argue that the mutual funds we identify as Leaders are special, and that there is data consistent with them having superior skill and/or information.

Table IX shows the results of a difference-in-difference test. We regress the returns of all mutual funds in our sample on a number of dummy variables, and controls. We are mostly interested in how the performance of the different funds (Leaders, Followers, rest of the sample) is affected at the beginning and end of the recent financial crisis. In particular, we focus on a period that marks the first few months of the recession, and another period towards its end (all recession data obtained from NBER data). When the recession hits the markets, all fund managers are caught equally by surprise (D startrec coefficient is -0.042 and significant), and we can see that there is no difference in performance in the Leader and Follower groups, as evinced in their dummy variables interacted with an indicator variable for the start of the recession (D follower * D startrec and D leader * D startrec, respectively). However, as the recession comes to its final months, the interaction of the end of recession dummy with the leader dummy (D leader * D endrec) is positive.
and significant, showing that Leader funds recuperate faster than their peers. The same interaction is not significant for Follower funds. Thus, we see that fund managers labeled as Leaders to seem to have an edge not shared by their peers, which bolsters our claim that identifying them and imitating their holdings is a source of value for investors.

[TABLE IX HERE]

Finally, we also test the persistence of the Leader denomination. In the literature in mutual fund performance persistence the consensus is that, if there is any persistence at all, it is only in the short term, defined as a year or so. In Table X we present the results of a Probit regression, where the dependent variable is a dummy with takes the value of 1 if a certain fund is a Leader in any given quarter of our sample. Regressors include lags of the same dummy and control variables. As we can see, the best predictor of the Leader status is having been one in a previous period. However, this predictability erodes in time, as we can see by the diminishing value of the dummy lag coefficients. In the Table we only report the first four lags of the variable, which encompass four quarters or a full year, after which a Leader fund still has a 30% probability of maintaining its status the next quarter, simply because it is a Leader in the present quarter. In unreported tests, we see that after about a year and a half the conditional probability erodes down to the unconditional probability of being a Leader, that is, the number of Leader funds selected divided by the total number of funds in the sample. In other words, the persistence of the Leader status is consistent with other results in the performance persistence literature, in that Leader funds can expect to remain in that list for around a year. The consequence of this is that any copycat strategy that attempts to follow a fund (or funds) for a longer period of time is bound to underperform. Not only
is it crucial to identify the right Leaders to imitate, the list of these Leaders must also be updated regularly using the copycat measure.

[TABLE X HERE]

To summarize our results: we find that, unlike in previous papers, it is possible to generate a mimicking portfolio strategy that gleans valuable information from the portfolio holding disclosures of some mutual funds. These portfolios obtain positive and significant alphas, even after deducting trading costs. However, the strategy relies on mimicking only Leaders funds (which themselves do not outperform the market), as identified using the copycat measure, and the list of these Leaders must be updated as the persistence of the classification is short term. Finally, the performance of the strategy does not rely on short positions, nor can it be traced to alternative, easier to implement and formerly identified investment strategies, but seems to rely solely in superior information gleaned from aggregating the ‘wisdom’ of a large number of fund managers which engage in varying levels of imitating and being imitated by others.
4. Conclusions

We introduce a new measure to quantify copycat activity of mutual fund managers. Using this measure to analyze a large sample of U.S. equity mutual funds, we find that fund managers that engage in this behavior as a predominant strategy do not outperform the market nor their peers. However, an investment strategy that utilizes this same measure to identify and imitate the holdings of those funds that are most copied by other managers does outperform the market, in terms of both, larger returns net of trading costs and positive and significant factor model alphas. We surmise that the success of this strategy is due in part to the superior information contained in these Leader funds’ portfolio holding disclosures. But, since the actual Leader funds that we select to mimic do not themselves outperform, we also conclude that this potential skill is clouded by other factors, primarily a tendency to overtrade, generating higher trading costs that those incurred by our mimicking portfolios, which are restricted to trading once every quarter.

Using our copycat measure we make three important contributions to the literature. First, we show evidence that supports recent literature that shows that some fund managers do indeed have superior skill and could provide added value to their investors. However, that this skill is not translated into superior returns is due partly to the added expenses, as mentioned before, and also due to its relatively short term persistence, as the Leader status of any fund lasts on average a little over a year. Second, we show that mandated portfolio holding disclosures force these skillful fund managers to disclose information that, even allowing for the time between reporting date and the date in which the information becomes available to the general public, still has some potential value to investors. Finally, we show that so far copycat fund managers do not obtain a measurable benefit from imitating the disclosed holdings of other funds. However, this seems to be because
any one manager is unable to identify the Leader funds that disclose truly valuable information of portfolios worth mimicking. Once we aggregate the full mutual fund market’s copycat information using our measure, we are able to identify these Leader funds, and update our list of Leader funds as these change in time. Mimicking portfolios that imitate the holdings of these Leaders obtain the highest performance of all samples analyzed in this paper. Thus we show that it is possible to beat the market using the copycat measure to select Leader portfolios. Moreover, the proposed strategy has relatively low trading costs, as the portfolios need only be rebalanced once every quarter when new fund holdings information is released, and the strategies are long-only, avoiding costs and restrictions of previously reported anomaly-based investment strategies that rely on short positions.

While most of the prevailing literature on fund manager skill is focused on the potential sources of that skill, or in identifying skillful fund managers, or predicting future performance based on certain management characteristics, we explore a new avenue to improved performance. In the world of mutual fund managers there seems to be certain truth to the old saying “imitation is the sincerest form of flattery”. If we consider a fund manager’s opinion about a colleague’s skill to be represented by the degree to which the manager imitates his fellow fund manager, then by aggregating the combined opinions of all fund managers in the market, we are capable of identifying truly skillful fund managers, those whose disclosed portfolio data has the highest value for a high performance copycat strategy.
References


Phillips, B., Pukthuanthong, K., & Rau, P. R. (2014). Detecting Superior Mutual Fund


Image I: Illustration of the copycat measure calculation

Vectors representing five years of inferred trades of each stock for each fund are used in the estimation of a VAR model where the trades the stock by one fund at time $t$ are explained by trades of the same stock by both funds at time $t-1$. The fitted model is then used as input to test for Granger causality in both directions, Fund A follows Fund B’s trades or vice versa. The image illustrates the results of these Granger tests for the eight stocks held in common by funds A and B, and the direction of Granger causality is shown by the direction of the arrow the joins each stock held by each fund. Each Granger test adds a single count to each fund’s total of stocks in which they tend to follow the other’s trades, lead the other’s trades, do both or neither. The counts are added for all stocks held in common, and these sums are used to generate the copycat measure. For example, for Stock 1 (see dashed box), the arrow indicates that Fund A’s trades Granger cause, or follows, Fund B’s trades. Thus Fund A receives one count of following (+1 in the #F column), and Fund B receives a count of leading (+1 in #L column).
**Image II: Copycat measure probability density**

The kernel density estimation of the copycat measure is plotted using the data for a selected period of the measure for each fund active in that period. The x axis contains the values of the copycat measure, and the y axis depicts frequency / probability.
Table I: Descriptive Statistics of U.S. Equity Mutual Funds

Statistics presented include Mean, Median, and standard deviation (St.Dev.) for each of the mutual fund characteristics for the full sample of funds ("All Funds"), as well as those with a copycat measure in the highest 5% of the sample ("Leaders") and those and those with a measure in the lowest 5% of the sample ("Followers"). The variables analyzed include Total Net Assets (TNA, in millions of dollars), Expense Ratio (Exp.Ratio), Turnover Ratio (Turn. Ratio), 12b1 charges, percent of capital invested in common stock (Per. Com.), age of fund (Fund Age, in years), number of stocks in portfolio (Num. Stocks), average market cap of stocks in portfolio (McCap, in millions of dollars), and average stock price of stocks in portfolio (Stock Price, in dollars). Panel A contains descriptive statistics for the full time series, while panels B and C describe the sample before and after the 2004 portfolio disclosure regulation change, and Panels D and E show statistics for the periods before and after the recent financial crisis.

Panel A: Full Sample 1999:12 - 2013:12

<table>
<thead>
<tr>
<th>All Funds</th>
<th>Leaders</th>
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<tr>
<td>TNA</td>
<td>Mean</td>
<td>Median</td>
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<tr>
<td>Per. Com.</td>
<td>94.428</td>
<td>96.510</td>
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<td>12b1</td>
<td>0.004</td>
<td>0.002</td>
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<td>Exp. Ratio</td>
<td>0.013</td>
<td>0.012</td>
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<tr>
<td>Mgmt. Fee</td>
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<td>0.750</td>
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<td>Turn. Ratio</td>
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<td>Stock Prices</td>
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<td>Num. Funds</td>
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<td>1,134</td>
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</table>

Panel B: Pre Regulation Change 1999:12 - 2003:12

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</thead>
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<td>Num. Funds</td>
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Panel C: Post regulation change 2005:01 - 2013:12

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<td>12b1</td>
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<td>Exp. Ratio</td>
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<tr>
<td>Mgmt. Fee</td>
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### Panel D: Pre crisis 1999:12 - 2007:12

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<td>0.003</td>
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<td>0.013</td>
<td>0.012</td>
<td>0.005</td>
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<td>Mgmt. Fee</td>
<td>0.756</td>
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<td>Turn. Ratio</td>
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<td>Stock Prices</td>
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### Panel E: Post crisis 2009:12 - 2013:12

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</thead>
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<tr>
<td></td>
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<td>St.Dev.</td>
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<td>TNA</td>
<td>893</td>
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<td>Num. Funds</td>
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<td>149</td>
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Table II: Performance of Mimicking Portfolios

Individual mimicking portfolio returns (net of trading costs as represented by bid-ask spreads) are averaged within groups representing the full sample ('All Funds'), those with a copycat measure in the lowest 5% of the sample ('Followers'), those with the within the highest 5% of the sample ('Leaders'), and those funds with a copycat score of zero ('Zeros'). The data spans the period 1999:12 - 2013:12. Panel A contains performance statistics for these samples, including Holding Period Return ('HPR'), mean monthly return ('Mean.Ret.'), standard deviation ('St.Dev.'), and Sharpe Ratio. Panel B shows the point estimate of paired t-tests (two-tailed) differences between the various samples. Statistical significance is denoted by ***, ** and * for the 1%, 5% and 10% levels, respectively.

### Panel A: Univariate Statistics

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<th>Mean.Ret.</th>
<th>StDev</th>
<th>Sharpe</th>
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<tbody>
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<td>0.005</td>
<td>0.047</td>
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<td>All Funds</td>
<td>1.159</td>
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<td>2.418</td>
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<td>0.006</td>
<td>0.054</td>
<td>0.104</td>
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### Panel B: Paired t-tests

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</tr>
</thead>
<tbody>
<tr>
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<td>0.0040***</td>
<td>0.0039***</td>
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<tr>
<td>All Funds</td>
<td>0.0028***</td>
<td>0.0026***</td>
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<tr>
<td>Zeros</td>
<td>0.0005</td>
<td>0.0036***</td>
<td>0.0032***</td>
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Table III: Sorts on copycat measure and subsequent quarter traded stock performance

Stock picking skill is evaluated in terms of the subsequent performance of stocks traded by all mutual funds. Performance is defined as the return (net of trading costs as represented by bid-ask spreads) of stocks in the quarter after they have been traded by each fund, as inferred from the changes in number of shares reported in the previous quarter. For each period, each fund’s traded stocks’ subsequent return is averaged. Then we obtain the aggregate performance of groups of funds by averaging individual stock picking performance across groups defined as ‘Leaders’, those with a copycat measure in the lowest 5% of the sample (‘Followers’), those with the within the highest 5% of the sample (‘Leaders’), and those funds with a copycat score of zero (‘Zeros’). Within each group returns are then sorted into quintiles. The data spans the period 1999:12 - 2013:12. Two-tailed t-tests are reported for the difference between the highest (Q5) and lowest (Q1) return quintiles, as well as between Leaders and Zeros (‘LMZ’), and Followers and Zeros (FMZ). Statistical significance of difference tests is denoted by ***, ** and * for the 1%, 5% and 10% levels, respectively.

<table>
<thead>
<tr>
<th></th>
<th>Leaders</th>
<th>Followers</th>
<th>Zeros</th>
<th>LMZ</th>
<th>FMZ</th>
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<tr>
<td>Q1</td>
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<td>-0.074</td>
<td>-0.074</td>
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<td>-0.0001</td>
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<tr>
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<td>-0.015</td>
<td>-0.015</td>
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<td>Q3</td>
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<td>0.015</td>
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<tr>
<td>Q4</td>
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<td>0.034</td>
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<td>Q5</td>
<td>0.081</td>
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<td>0.071</td>
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<td>0.009</td>
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<td>0.154***</td>
<td>0.145***</td>
<td>0.012</td>
<td>0.009</td>
</tr>
</tbody>
</table>
Table IV: Factor Model Regressions of Mimicking Portfolios

Mimicking portfolio time series of returns (net of trading costs as represented by bid-ask spreads) are regressed on a four factor model, where the factors are the market return (Market), firm size (SMB), book to market (HML) and momentum (UMD), and Alpha is the regression intercept. The returns regressed on this model are obtained by imitating the holdings of groups of real mutual funds. Mutual fund portfolio holding disclosures are assumed to occur 60 days after the end of the reporting period. These groups are all the funds in the sample (1), those with a copycat measure in the lowest 5% of the sample (2), those with the within the highest 5% of the sample, and those funds with a copycat score of zero (4). Additionally, hedge portfolio returns are used, where the portfolios are formed with a short position in the zero scoring funds, and a long position in the higher 5% funds (5), the lower 5% funds (6), and the full sample (7). Statistical significance is denoted by ***, ** and * for the 1%, 5% and 10% levels, respectively.

<table>
<thead>
<tr>
<th></th>
<th>All Funds</th>
<th>Followers</th>
<th>Leaders</th>
<th>Zeros</th>
<th>Lead-Zero</th>
<th>Foll-Zero</th>
<th>All-Zero</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alpha</strong></td>
<td>0.0002</td>
<td>0.0015</td>
<td>0.0022**</td>
<td>-0.0002</td>
<td>0.0024**</td>
<td>0.0017</td>
<td>0.0003</td>
</tr>
<tr>
<td></td>
<td>(0.0009)</td>
<td>(0.0010)</td>
<td>(0.0009)</td>
<td>(0.0011)</td>
<td>(0.0010)</td>
<td>(0.0011)</td>
<td>(0.0009)</td>
</tr>
<tr>
<td><strong>Market</strong></td>
<td>1.1015***</td>
<td>1.0797***</td>
<td>1.1115***</td>
<td>1.0407***</td>
<td>0.0707***</td>
<td>0.0389</td>
<td>0.0608***</td>
</tr>
<tr>
<td></td>
<td>(0.0211)</td>
<td>(0.0228)</td>
<td>(0.0213)</td>
<td>(0.0260)</td>
<td>(0.0245)</td>
<td>(0.0252)</td>
<td>(0.0209)</td>
</tr>
<tr>
<td><strong>SMB</strong></td>
<td>0.1451***</td>
<td>0.3214***</td>
<td>0.2741***</td>
<td>0.1780***</td>
<td>0.0961***</td>
<td>0.1434***</td>
<td>-0.0329</td>
</tr>
<tr>
<td></td>
<td>(0.0277)</td>
<td>(0.0300)</td>
<td>(0.0279)</td>
<td>(0.0341)</td>
<td>(0.0322)</td>
<td>(0.0331)</td>
<td>(0.0274)</td>
</tr>
<tr>
<td><strong>HML</strong></td>
<td>0.0201</td>
<td>0.1386***</td>
<td>0.0529*</td>
<td>-0.0027</td>
<td>0.0556*</td>
<td>0.1413***</td>
<td>0.0228</td>
</tr>
<tr>
<td></td>
<td>(0.0269)</td>
<td>(0.0291)</td>
<td>(0.0271)</td>
<td>(0.0331)</td>
<td>(0.0313)</td>
<td>(0.0321)</td>
<td>(0.0266)</td>
</tr>
<tr>
<td><strong>UMD</strong></td>
<td>-0.0449***</td>
<td>-0.0391**</td>
<td>-0.0308*</td>
<td>-0.0558***</td>
<td>0.0249</td>
<td>0.0166</td>
<td>0.0109</td>
</tr>
<tr>
<td></td>
<td>(0.0159)</td>
<td>(0.0172)</td>
<td>(0.0160)</td>
<td>(0.0196)</td>
<td>(0.0185)</td>
<td>(0.0190)</td>
<td>(0.0158)</td>
</tr>
<tr>
<td><strong>Observations</strong></td>
<td>169</td>
<td>169</td>
<td>169</td>
<td>169</td>
<td>169</td>
<td>169</td>
<td>169</td>
</tr>
<tr>
<td><strong>R²</strong></td>
<td>0.96067</td>
<td>0.95580</td>
<td>0.96272</td>
<td>0.93732</td>
<td>0.13854</td>
<td>0.17986</td>
<td>0.05568</td>
</tr>
<tr>
<td><strong>Adjusted R²</strong></td>
<td>0.95971</td>
<td>0.95473</td>
<td>0.96181</td>
<td>0.93579</td>
<td>0.11753</td>
<td>0.15986</td>
<td>0.03265</td>
</tr>
</tbody>
</table>
Table V: Factor Model Regressions of Mimicking Portfolios, Alternative Specifications

Mimicking portfolio time series of returns (net of trading costs as represented by bid-ask spreads) are regressed on a four factor model, where the factors are the market return (Market), firm size (SMB), book to market (HML) and momentum (UMD), and Alpha is the regression intercept. The returns regressed on this model are obtained by imitating the holdings of groups of real mutual funds with a copycat measure in the lowest 5% of the sample ("Followers") and those with the within the highest 5% of the sample ("Leaders"). In models (1) and (2) mimicking portfolios are formed using equal weighted (EW) imitations of their respective fund holdings. The other models are estimated using portfolios that mimic the stocks that compose the top holdings of mutual funds, in terms of their added portfolio weights. Models (3) and (4) mimic the top 75% holdings, (5) and (6) the top 50%, and (7) and (8) the top 25%. Mutual fund portfolio holding disclosures are assumed to occur 60 days after the end of the reporting period. Statistical significance is denoted by ***, ** and * for the 1%, 5% and 10% levels, respectively.

<table>
<thead>
<tr>
<th>Restricted Mimicking Portfolio Returns</th>
<th>Leaders EW</th>
<th>Followers EW</th>
<th>Leaders 75%</th>
<th>Followers 75%</th>
<th>Leaders 50%</th>
<th>Followers 50%</th>
<th>Leaders 25%</th>
<th>Followers 25%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha</td>
<td>-0.00261</td>
<td>0.00138</td>
<td>0.00291***</td>
<td>0.00180</td>
<td>0.00349***</td>
<td>0.00200</td>
<td>0.00388***</td>
<td>0.00192</td>
</tr>
<tr>
<td>(0.00468)</td>
<td>(0.00086)</td>
<td>(0.00100)</td>
<td>(0.00110)</td>
<td>(0.00113)</td>
<td>(0.00126)</td>
<td>(0.00136)</td>
<td>(0.00157)</td>
<td></td>
</tr>
<tr>
<td>Market</td>
<td>1.23248***</td>
<td>1.07691***</td>
<td>1.0881***</td>
<td>1.09432***</td>
<td>1.10568***</td>
<td>1.10345***</td>
<td>1.12928***</td>
<td>1.10282***</td>
</tr>
<tr>
<td>(0.11211)</td>
<td>(0.02066)</td>
<td>(0.02402)</td>
<td>(0.02603)</td>
<td>(0.02694)</td>
<td>(0.03017)</td>
<td>(0.03247)</td>
<td>(0.03760)</td>
<td></td>
</tr>
<tr>
<td>SMB</td>
<td>0.26928*</td>
<td>0.34585***</td>
<td>0.25374***</td>
<td>0.29159***</td>
<td>0.23841***</td>
<td>0.30372***</td>
<td>0.24928***</td>
<td>0.34081***</td>
</tr>
<tr>
<td>(0.14709)</td>
<td>(0.02711)</td>
<td>(0.03152)</td>
<td>(0.03415)</td>
<td>(0.03535)</td>
<td>(0.03958)</td>
<td>(0.04261)</td>
<td>(0.04933)</td>
<td></td>
</tr>
<tr>
<td>HML</td>
<td>-0.16229</td>
<td>0.17322***</td>
<td>0.09030</td>
<td>0.09519***</td>
<td>0.00798</td>
<td>0.08023**</td>
<td>-0.02405</td>
<td>0.06570</td>
</tr>
<tr>
<td>(0.14296)</td>
<td>(0.02635)</td>
<td>(0.03063)</td>
<td>(0.03320)</td>
<td>(0.03435)</td>
<td>(0.03847)</td>
<td>(0.04141)</td>
<td>(0.04795)</td>
<td></td>
</tr>
<tr>
<td>UMD</td>
<td>-0.12459</td>
<td>-0.14038***</td>
<td>0.08601***</td>
<td>0.08892***</td>
<td>0.12035***</td>
<td>0.11270***</td>
<td>0.15796***</td>
<td>0.14308***</td>
</tr>
<tr>
<td>(0.08462)</td>
<td>(0.01560)</td>
<td>(0.01813)</td>
<td>(0.01965)</td>
<td>(0.02033)</td>
<td>(0.02277)</td>
<td>(0.02451)</td>
<td>(0.02838)</td>
<td></td>
</tr>
</tbody>
</table>

| Observations                          | 169        | 169          | 169         | 169           | 169         | 169          | 169         | 169           |
| R^2                                   | 0.55609    | 0.96654      | 0.94758     | 0.93971       | 0.93522     | 0.92181      | 0.91202     | 0.88520       |
| Adjusted R^2                          | 0.54526    | 0.96573      | 0.94630     | 0.93824       | 0.93364     | 0.91990      | 0.90987     | 0.88240       |
Table VI: Factor Model Regressions of Mimicking Portfolios Formed Using Amihud and Goyenko’s (2013) $R^2$

Portfolio time series of returns (net of trading costs as represented by bid-ask spreads) are regressed on a four factor model, where the factors are the market return (Market), firm size (SMB), book to market (HML) and momentum (UMD), and Alpha is the regression intercept. The returns regressed on this model are obtained by imitating the holdings of groups of real mutual funds. These groups are all the funds in the sample (1), those with a R squared measure in the lowest 5% of the sample (2), and those with R squared measure within the highest 5% of the sample. Statistical significance is denoted by ***, ** and * for the 1%, 5% and 10% levels, respectively.

<table>
<thead>
<tr>
<th>Dependent variable:</th>
<th>All Funds</th>
<th>Low $R^2$</th>
<th>High $R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>Alpha</td>
<td>-0.001</td>
<td>0.0005</td>
<td>-0.0003</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.0005)</td>
</tr>
<tr>
<td>Market</td>
<td>1.091***</td>
<td>1.074***</td>
<td>1.040***</td>
</tr>
<tr>
<td></td>
<td>(0.015)</td>
<td>(0.036)</td>
<td>(0.013)</td>
</tr>
<tr>
<td>SMB</td>
<td>0.206***</td>
<td>0.223***</td>
<td>0.029</td>
</tr>
<tr>
<td></td>
<td>(0.025)</td>
<td>(0.061)</td>
<td>(0.022)</td>
</tr>
<tr>
<td>HML</td>
<td>-0.052**</td>
<td>0.077</td>
<td>-0.001</td>
</tr>
<tr>
<td></td>
<td>(0.024)</td>
<td>(0.058)</td>
<td>(0.021)</td>
</tr>
<tr>
<td>UMD</td>
<td>-0.025**</td>
<td>0.012</td>
<td>-0.013</td>
</tr>
<tr>
<td></td>
<td>(0.012)</td>
<td>(0.029)</td>
<td>(0.010)</td>
</tr>
<tr>
<td>Observations</td>
<td>135</td>
<td>135</td>
<td>135</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.985</td>
<td>0.919</td>
<td>0.987</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.985</td>
<td>0.917</td>
<td>0.987</td>
</tr>
</tbody>
</table>
Individual fund returns are averaged within groups representing the full sample ('All Funds'), those with a copycat measure in the lowest 5% of the sample ('Followers'), those with the within the highest 5% of the sample ('Leaders'), and those funds with a copycat score of zero ('Zeros'). The data spans the period 1999:12 - 2013:12. Panel A contains performance statistics for these samples, including Holding Period Return ('HPR'), mean monthly return ('Mean.Ret.'), standard deviation ('St.Dev.'), and Sharpe Ratio. Panel B shows the point estimate of paired t-tests (two-tailed) between the various samples. Statistical significance is denoted by ***, ** and * for the 1%, 5% and 10% levels, respectively.

### Panel A: Univariate Statistics

<table>
<thead>
<tr>
<th></th>
<th>Hold.Ret.</th>
<th>Mean.Ret.</th>
<th>StDev</th>
<th>Sharpe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market</td>
<td>0.923</td>
<td>0.005</td>
<td>0.047</td>
<td>0.106</td>
</tr>
<tr>
<td>All Funds</td>
<td>1.143</td>
<td>0.006</td>
<td>0.049</td>
<td>0.117</td>
</tr>
<tr>
<td>Leaders</td>
<td>1.297</td>
<td>0.006</td>
<td>0.052</td>
<td>0.121</td>
</tr>
<tr>
<td>Followers</td>
<td>1.479</td>
<td>0.007</td>
<td>0.051</td>
<td>0.131</td>
</tr>
<tr>
<td>Zeros</td>
<td>0.977</td>
<td>0.005</td>
<td>0.048</td>
<td>0.109</td>
</tr>
</tbody>
</table>

### Panel B: Paired t-tests

<table>
<thead>
<tr>
<th></th>
<th>All Funds</th>
<th>Leaders</th>
<th>Followers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market</td>
<td>0.0008</td>
<td>0.0013</td>
<td>0.0017</td>
</tr>
<tr>
<td>All Funds</td>
<td>0.0006</td>
<td>0.0006*</td>
<td>0.0010*</td>
</tr>
<tr>
<td>Followers</td>
<td>−0.0004</td>
<td>0.0011</td>
<td>0.0015**</td>
</tr>
<tr>
<td>Zeros</td>
<td>0.0006**</td>
<td>0.0011</td>
<td>0.0015**</td>
</tr>
</tbody>
</table>
Table VIII: Factor Model Regressions of Mutual Fund Returns

Mutual fund times series of returns are regressed on a four factor model, where the factors are the market return (Market), firm size (SMB), book to market (HML) and momentum (UMD), and Alpha is the regression intercept. Individual fund returns are averaged within groups representing the full sample (1), those with a copycat measure in the lowest 5% of the sample (2), those with the within the highest 5% of the sample, and those funds with a copycat score of zero (4). The data spans the period 1999:12 - 2013:12. Statistical significance is denoted by ***, ** and * for the 1%, 5% and 10% levels, respectively.

<table>
<thead>
<tr>
<th>Dependent variable:</th>
<th>All Funds</th>
<th>Followers</th>
<th>Leaders</th>
<th>Zeros</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>Alpha</td>
<td>-0.0003</td>
<td>-0.0003</td>
<td>-0.001</td>
<td>-0.0003</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.0005)</td>
</tr>
<tr>
<td>Market</td>
<td>1.009***</td>
<td>0.998***</td>
<td>1.018***</td>
<td>0.991***</td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
<td>(0.020)</td>
<td>(0.018)</td>
<td>(0.012)</td>
</tr>
<tr>
<td>SMB</td>
<td>0.149***</td>
<td>0.286***</td>
<td>0.298***</td>
<td>0.100***</td>
</tr>
<tr>
<td></td>
<td>(0.016)</td>
<td>(0.026)</td>
<td>(0.023)</td>
<td>(0.016)</td>
</tr>
<tr>
<td>HML</td>
<td>0.079***</td>
<td>0.163***</td>
<td>0.085***</td>
<td>0.015</td>
</tr>
<tr>
<td></td>
<td>(0.016)</td>
<td>(0.025)</td>
<td>(0.023)</td>
<td>(0.015)</td>
</tr>
<tr>
<td>UMD</td>
<td>0.005</td>
<td>-0.014</td>
<td>0.024*</td>
<td>0.013</td>
</tr>
<tr>
<td></td>
<td>(0.009)</td>
<td>(0.015)</td>
<td>(0.013)</td>
<td>(0.009)</td>
</tr>
<tr>
<td>Observations</td>
<td>169</td>
<td>169</td>
<td>169</td>
<td>169</td>
</tr>
<tr>
<td>R²</td>
<td>0.982</td>
<td>0.959</td>
<td>0.968</td>
<td>0.983</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.982</td>
<td>0.958</td>
<td>0.967</td>
<td>0.983</td>
</tr>
</tbody>
</table>
Table IX: Diff in Diff Test

The dependent variable is mutual fund excess returns. Regressors include dummy variables for the sample of funds with a copycat score in the top 5% (D leader) and bottom 5% (D follower), as well as for indicating the time period spanning the recent economic recession according to NBER data, Dec 2012 to June 2009 (D fullrec), and sub-periods chosen to reflect the beginning of the recession, Dec 2007 to June 2008 (D startrec), and the end of the recession, Dec 2008 to June 2009 (D endrec). A standard set of controls are used in models (2), (4) and (6). These include the natural log of the fund’s Total Net Assets (‘logTNA’), the turnover ratio, expense ratio and fund age in years. The data spans the period 1999:12 - 2013:12. Statistical significance is denoted by ***, ** and * for the 1%, 5% and 10% levels, respectively.

<table>
<thead>
<tr>
<th>Dependent variable: Monthly Fund Excess Returns</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
</tr>
<tr>
<td>D leader</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>D follower</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>D fullrec</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>D leader * D fullrec</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>D follower * D fullrec</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>D startrec</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>D leader * D startrec</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>D follower * D startrec</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>D endtrec</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>D leader * D endtrec</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>D follower * D endtrec</td>
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<td></td>
</tr>
<tr>
<td>logTNA</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Turn Ratio</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Fund Age</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Exp Ratio</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Observations 98,630 92,536 98,630 92,536 98,630 92,536
R² 0.015 0.020 0.031 0.035 0.028 0.032
Adjusted R² 0.015 0.020 0.031 0.035 0.028 0.032
Table X: Persistence of Leader Status of Mutual Funds

The dependent variable in these models is a dummy that indicates whether a fund is a member of the leader group (5% top score in the copycat measure) in a specific period of time (a quarter). This dummy is regressed on various lags of itself (‘Dummy1’ = 1 lag of dummy, and so on), as well as various fund characteristics usually employed as controls. Statistical significance is denoted by ***, ** and * for the 1%, 5% and 10% levels, respectively.

<table>
<thead>
<tr>
<th>Dependent variable:</th>
<th>Prob of Being a Leader</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>Dummy1</td>
<td>0.568***</td>
<td>0.445***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.004)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dummy2</td>
<td>0.444***</td>
<td>0.133***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.004)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dummy3</td>
<td>0.367***</td>
<td>0.065***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.004)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dummy4</td>
<td></td>
<td>0.307***</td>
<td>0.047***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.004)</td>
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<td>85,421</td>
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